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UNIVERSITY OF ALBERTA

CANADIAN ORTHODONTISTS' DECISIONS IN BORDERLINE ORTHOGNATHIC SURGERY CASES

BY

NANCY WEAVER

©

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfilment of the requirements for the degree of

MASTER OF SCIENCE

IN

CLINICAL SCIENCES

FACULTY OF DENTISTRY

EDMONTON, ALBERTA
SPRING, 1993

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled CANADIAN ORTHODONTISTS' DECISIONS IN BORDERLINE ORTHOGNATHIC SURGERY CASES submitted by NANCY ELLA WEAVER in partial fulfilment of the requirements for the degree of MASTER OF SCIENCE in CLINICAL SCIENCES (ORTHODONTICS).

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"An intellectual is someone whose mind watches itself."

A. Camus

DEDICATION

This thesis is dedicated with love and appreciation to two groups of people: those who supported and tolerated me most during its construction... Ronan Cahill, Karen Weaver, and James Weaver; and those with whom I would have liked to spend more time during the associated degree program...Ella Lahey, Ronan Cahill, Karen Weaver, James Weaver, Duane Weaver, Kelly Weaver, Josh and April Weaver.

ABSTRACT

Although clinical decision-making in dentistry was described in mid-1991 as being on the "cutting edge of research and development", there has been little formal application of decision theory to orthodontics as yet. Of the areas in orthodontics to which decision theory could be applied, orthognathics stands to benefit the most. Borderline orthognathic decisions are great challenges: they are risky or uncertain (probabilities of outcomes may or may not be known), open (a list of treatment options specific to each patient must be formulated), and static (the decision occurs months in advance of the outcome). Also, outcomes of borderline orthognathic decisions can differ considerably with respect to morbidity and esthetics. Responses to a mail survey of Canadian orthodontists (334 respondents or 65% response rate) were analyzed to describe orthodontists' decisions in borderline orthognathic surgery cases. Tests of seven major hypotheses determined the influence of orthodontists' traits over their treatment recommendations. Respondents' decisions were not influenced by: respondent perception of oral surgeon or psychologist availability, expertise or rapport with the orthodontist; respondent facial self-image; or perception of surgical costs as a burden to patient or health care system. Certain perceptions of justification for cost of surgery for varying degrees of functional or esthetic compromise influenced decisions, as did flexibility in changing treatment plan mid-treatment for the anxious patient. Surgical recommendation increased linearly with recency of graduation. Recommendation for psychological referral (infrequent) coincided with "no treatment" recommendation. Some analyses indicated individual respondent tendencies toward recommending surgery or camouflage. Nineteen hypotheses regarding the influence of patient traits over orthodontists' decisions were tested using 23 case vignettes. Certain physical, psychological, attitudinal and support system characteristics of patients influenced decisions in favour of surgery or camouflage while others had no influence. Treatment recommendations were usually consistent with knowledge of patient psychological reaction to treatment as discussed in psychological literature. However, the orthodontic community may lack familiarity with some psychological aspects of orthognathic surgery. In conclusion, certain orthodontist and patient traits influenced orthodontists' decisions in borderline orthognathic surgery cases. There is great potential for future orthodontic decision analysis.

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LIST OF STATISTICAL ABBREVIATIONS

Statistical Abbreviations

symbol	statistical meaning
m	sample mean
n	number in sample
P	probability
df	degrees of freedom
r	Pearson's correlation coefficient
X^2	chi-square
t	Student distribution
ANOVA	analysis of variance
F	variance ratio
α	experiment-wise error rate
SE	standard error
SSH	sum of squares, hypothesis
SSE	sum of squares, error
MSH	mean square, hypothesis
MSE	mean square, error
DFH	degrees of freedom, hypothesis
DFE	degrees of freedom, error
GM	grand mean, ANOVA
!	Greenhouse-Geiser adjusted
Σ	epsilon
c	cases, ANOVA

I. INTRODUCTION

Statement of the Problem; Purpose of the Study; Research Questions

Traditional orthodontic literature provides the orthodontist with a database for decision-making with respect to diagnosis and treatment while only a small portion of orthodontic literature is devoted to the analysis of such decision-making. The purpose of this thesis was to describe orthodontists' decision-making in borderline orthognathic surgery cases.

Using ethnographic and scholarly methodologies, potential influences over orthodontists' treatment recommendations in borderline orthognathic surgery decisions were defined and can be broadly categorized: orthodontist personal and practice traits; orthodontist perception of patient traits; and orthodontist perception of traits of oral surgeons and psychologists.

There were three primary research questions. First, do the aforementioned traits influence which treatment options are recommended to borderline orthognathic patients by the orthodontist? Second, do orthodontists act in accord with orthognathic and plastic surgery literature with respect to making recommendations for patients whose psychology makes them good or poor surgical candidates? Last, are orthodontists' recommendations for oral surgery or psychology consultation influenced by orthodontist perception of traits of available oral surgeons or psychologists respectively?

Borderline orthognathic decision-making was investigated by analysing results of a case vignette-style mail survey of licensed Canadian orthodontists.

Definition of the Problem

The borderline orthognathic case is one which could be treated either with combined orthodontics and orthognathic surgery or with camouflage orthodontics. For the borderline patient, 'camouflage orthodontics' implies creating excessive dental compensation for a skeletal malrelationship (i.e. moving the teeth to the limits of their corresponding jaw bone to create a proper dental relationship despite a skeletal malrelationship). For the borderline patient, orthognathic surgery would require repositioning of jaw bone segments over a relatively small distance.

Certain skeletal or dental traits of the patient may influence orthodontists' decisions as to the feasibility of camouflage. Patient physical, psychological, attitudinal and support system traits were investigated in the present study using case vignettes. By definition, both surgical and camouflage options could have been recommended to the borderline vignette patients by respondents in this study unless vignette traits legitimately influenced decision-making in favour of either surgery or camouflage.

The borderline orthognathic case is a decision challenge in many respects. A decision to undergo surgery is usually made approximately eighteen months prior to the actual surgery, thereby prolonging the patient's pre-surgical apprehension and creating greater opportunity for the patient to deliberate upon the decision. The delay creates an extremely static choice situation[1] in which the decision must be made well before resolution of any uncertainty with respect to outcome.

In risky decisions the probabilities of more than one possible outcome are known for each alternative, whereas in uncertain decisions such probabilities are unknown or meaningless.[2] The borderline orthognathic situation presents as risky where outcomes can be predicted based on knowledge or experience (eg. predicting post-treatment soft tissue and dental result, predicting surgical morbidity). Where outcomes cannot be predicted due to lack of available literature or the unique features of a case, the situation is uncertain (eg. predicting patients' psychological reaction to treatment outcomes).

Surgical and camouflage options differ with respect to potential morbidity. Orthognathic surgery carries the risks of general anaesthesia, immediate post-surgical complications and long-term complications such as paraesthesia, surgical relapse and orthodontic relapse. Camouflage shares orthodontic risks with the surgical option and results facially in a more pronounced version of what originally might not have been esthetically ideal.

The financial cost to patients or provincial health care system of combined surgery and orthodontics versus camouflage orthodontics can differ.

The effects of both surgical and camouflage options may be irreversible.

Decision-making can be described as individual versus collective. Orthodontist and oral surgeon individually or collectively decide which treatment option(s) to offer the patient. The patient chooses an option, influenced by orthodontist, oral surgeon or support persons (spouse, family, friends) to varying degrees. Limitation of the patient's options by orthodontist, oral surgeon, or support person or patient decision under minimal influence from others would represent individual decision-making. In non-borderline cases, limitation of options is reasonable. However, in borderline cases, if there is a single decision-maker, it generally should be the psychologically competent patient. When a patient trait legitimately influences the treatment decision, a physically borderline situation may no longer be so 'borderline'.

Basic Principles of Decision Theory

Descriptive decision theory systematically describes how decisions are made. Decision-making behaviours revealed by systematic analysis allow induction of decision-makers' preferences for outcomes to decision alternatives.[3]

Decisions can be based on heuristics, which are mental "rules of thumb",[4] or algorithms, which are formal decision strategies.[5] In the orthodontic situation, heuristics might influence decisions dominated by few factors, where the dominant factors stimulate recall of a suitable heuristic. Algorithms might apply to decisions involving multiple factors of similar importance which require weighting and manipulation. In this study, respondents were presented with unidimensional vignette patients, so heuristics likely predominated. Respondents may have applied algorithms to groups of vignettes which addressed similar issues.

Heuristics may be based solely on intuition and thus are not infallible, but they reduce decision task complexity and give a fairly low rate of decision error.[5] Kozielecki[5] proposes that decision-makers should be instructed in using heuristics as well as algorithms: one can resort to heuristic strategies in new decision problems where suitable algorithms are unavailable while standard decision tasks can be handled using either approach.

Dental and Orthodontic Decision Literature

In the author's opinion, there is a logical event cycle for applying decision theory to clinical sciences. First, produce research to provide an ongoing database for decision-making. Second, make the database accessible to clinicians. Third, determine heuristics and algorithms appropriate for database manipulation such that clinicians can diagnose and treat patients effectively. Fourth, teach these heuristics and algorithms to clinicians, especially for difficult decision tasks such as the 'borderline' case. Concurrently, ensure that clinicians are capable of formulating their own heuristics and algorithms. Last, improve efficiency and accuracy by developing interactive decision-making computer programs.

The orthodontic decision cycle is as yet underdeveloped. Orthodontic literature constitutes a large, accessible database. Information is available on clinical decision analysis[6] and the value of decision theory to dentistry.[7] Availability of decision literature in more than ten dental disciplines from the late 1960's to the late 1980's[8] suggests that general dental heuristics and algorithms are available to incorporate into dental curricula. A paucity of orthodontic decision literature suggests inadequate formal determination of heuristics or algorithms necessary for incorporation into orthodontic curricula or for the production of interactive orthodontic decision-making computer programs.

Han, Vig, Weintraub, Vig and Kowalski[9] predict orthodontic treatment planning decisions almost as accurately for Class II patients based on study models alone as based on a combination of study models, facial photographs, panogram and lateral cephalogram. Perhaps study models dominate some orthodontic decisions. Such a descriptive study of orthodontic decision-making is rare at present.

Before dental decision literature was readily available, Ricketts felt there to be no substitute for individual clinical judgments based on experience.[10] With the state of the art, the equivalent for such judgments can exist in the form of interactive computer programs for orthodontic decision-making.

The value of a program interactive with respect to decision-making (and not just patient data entry) is appreciated by Faber, Burstone, and Solonche,[11] who claim the most important role of interaction to be resolution of decision feedback loops for which the computer has no defined function. Non-interactive programs are especially open to criticism with respect to decision individualization if their output is not critically evaluated by the user, or, as Graber says, if the clinician is lulled "...into a false sense of security and optimistic expectations" based on the scientific appearance of the output.[12]

Scholarly Generation of Hypotheses: Treatment Provider Traits

Such diversity exists between weights assigned by physicians to different decision-making variables that the level of agreement between physicians is not always above that of chance.[13] Thus, the nature of the diagnosis depends on the diagnostician. Likely the same can be said of the treatment recommendation.

Some variables examined in the present study were generated by reviewing medical as well as dental literature. Most medical literature, with the exception of plastic surgery literature, pertains to procedures which are less elective than orthognathic surgery. For example, morbidity or mortality may be outcomes of the "no treatment" medical option. There may be little time for deliberation in an emergency medical situation. Also, the patient may be unconscious or mentally incompetent and thus unable to make a decision. However, the decision task is similarly risky with respect to surgical morbidity and, in the case of plastic surgery, esthetic outcome.

Treatment planning decisions in early breast cancer are associated with physician specialty, paternalism (degree of importance attached to patient preference) and practice-related characteristics. Subjects who preferred conservative surgery also demonstrated greater willingness to involve the patient in the decision.[14]

The present study examined the influence of orthodontists' experience (measured primarily by graduation date) over their recommendations to the borderline orthognathic patient. Paternalism was examined to a degree by comparison between actual treatment recommendation and the 'ideal' recommendation of allowing patients to choose between orthognathic surgery, camouflage and no treatment.

Greer[15] suggests that physician bias may exist against plastic surgery where the physician cannot justify the expense of cosmetic surgery due to its relative unimportance in comparison to other illnesses. Long, Cummings and Frisof[16] have found that physicians tend to underestimate high prices of diagnostic tests more than they overestimate low prices, but generally give incorrect estimates. Underestimation creates greater demand for tests and overestimation creates less demand. Based on literature such as this, perception of orthognathic surgery as a financial burden to either patient or health care system and the influence of such perception over treatment recommendation in the borderline orthognathic surgery case were examined in the present study.

Differences exist between parents' and physicians' perceptions of plastic surgery for children with Down's Syndrome. Physicians view a hypothetical (questionnaire) patient's appearance less favourably than do parents, see the child as less well accepted by society, are slightly less concerned with surgical risks, and are much more likely to feel that surgery is advisable.[17] The results are interesting with respect to the extent to which parent and physician perception differ. In the present study the effect of discrepancies between support persons' and patient's wishes were examined with respect to their influence over orthodontists' recommendations.

Potential psychiatrist biases include the concepts that psychological problems cannot be solved by biological (surgical) intervention, a desire for elective cosmetic surgery indicates psychopathology, cosmetic surgery is only indicated if the patient is realistic about the degree of esthetic deficit associated with the defect, and a "...patient who can clearly articulate [their] motivations for ...surgery is a better candidate than one who cannot."[18] Awareness of practitioner biases in disciplines related to oral surgery and controversy as to what makes a patient a good surgical risk psychologically form part of the basis for the present study.

The present study examined the importance to respondents of the surgeon's ability to discuss surgical risks with a prospective orthognathic patient. The rationale was that post-surgical dissatisfaction results from unanticipated outcomes.[19] A well-informed patient would experience fewer unanticipated outcomes.

Thus far, review of the literature justified investigation of the influence over orthodontists' treatment recommendations of orthodontist experience, paternalism, knowledge of and attitude toward cost of surgery, perception of support system, realism of expectations and quality of risks discussion by oral surgeon.

Scholarly Generation of Hypotheses: Patient Traits

Depending on their area of specialization, physicians may allow patient age to influence treatment recommendations.[14]

Temporal variation in patient preference complicates formulation of a legitimate model of decisions by patients. Such variation occurs in obstetric decisions.[20] Temporal variation in preference may also be pertinent to the orthognathic situation given its static nature, and was included in the present study using a vignette patient hesitant to proceed with surgery following orthodontic preparation for surgery.

Part of the orthodontic database is oriented to psychological aspects of orthognathic patient management. A comprehensive review of this subject exists in the Craniofacial Growth Series published by the Centre for Human Growth and Development.[21] Information is available regarding psychological characteristics of potential orthognathic surgery patients,[22-24] psychological assessment of these patients using tests cited in the literature,[25-28] indications and methods for counselling both patient and support system[19,24,29-31] and short and long term psychological reactions of patients to orthognathic surgery. Patient psyche may influence the orthodontists' treatment recommendations if anticipated to affect the patient's acceptance of particular treatment outcomes.

Greater potential for post-surgical satisfaction is experienced by patients being treated for congenital defects or those related to growth and development than by patients being treated for traumatic or recently acquired defects.[32] Young patients with developmental deformities report greatly increased self-esteem post-surgically, which bodes well for the quality of their psychological adjustment to the post-surgical condition.[33] Adults with traumatic defects, however, invariably are disappointed that the post-surgical condition does not replicate the pre-surgical.[32] In the present study, orthodontists' treatment recommendations were examined for patients with either a developmental or a traumatic defect.

Satisfaction with surgery is better provided the patient does not project unrelated life problems onto the defect.[34] Realistic patient expectations of surgical results also affect post-surgical satisfaction positively,[35] although this concept has been challenged.[18] The issue of projection was addressed indirectly in the present study with a vignette in which the patient felt that negative life events could be improved with treatment leading to a positive facial change. The same vignette more directly addressed the second issue of realism of expectations.

Patients who are externally motivated to have surgery may not be as satisfied as patients who are internally motivated, especially if they do not receive adequate support from the external motivator.[36] Motivation source was addressed in the present study with three vignettes in which a patient favours a treatment option which the support system does not. In this situation the externally motivated patient would proceed with the option favoured by the support system.

It is possible for one physical characteristic to be less esteemed than others are and thus inconsistent with overall body image. Dislike for the inconsistent body part can cause reorganization of self-concept such that the entire body is perceived less favourably. A patient with an isolated inconsistency may be no more neurotic than other people and may reasonably seek correction of the inconsistency.[23] Patients with an underlying positive body image who are dissatisfied with only a particular aspect of their appearance, under self-consistency theory, are good surgical risks.[24] Nine months post-orthognathic surgery, overall body image is not significantly different from pre-surgery, chin image is better and facial image is worse.[37] Nine-month differences between self-image of various body parts are thought to be immediate reactions to facial change. During the more stable twenty-four month post-surgery assessment, there is a significant increase in overall body image and profile image.[38] Obviously, surgery should not be recommended if not anticipated to improve long-term facial image for patients with facial image inconsistency. Facial self-image inconsistency was addressed in the present study using a vignette patient possessing a generally good self-image except for an isolated facial inconsistency.

The influence of introversion versus extroversion over post-surgical satisfaction is not clear. Kiyak, Hohl, Sherrick, West, McNeill and Bucher[27] report a pre-surgical survey and three post-surgical (immediate, one month, four month) surveys of orthognathic patients in which higher post-surgical pain levels are reported by more introverted men. The authors suggest that introverted men should receive more intense counselling than extroverted men in order to deal with dissatisfaction over post-surgical pain. In another study, Kiyak, McNeill, West, Hohl and Heaton[39] find no correlation between measures of introversion-extroversion and post-surgical reports of dissatisfaction with outcomes up to six months after surgery. In the present study, treatment recommendations for the introverted versus the extroverted patient were examined.

There are conflicting reports in the orthodontic literature on the relationship between self-esteem and satisfaction with post-surgical outcomes. A six-month longitudinal comparison of patients who either underwent surgery, orthodontics alone, or no treatment, concludes that self-esteem is moderate to high for the three treatment groups up to six months post-surgery. No significant correlations exist at six months between measures of self-esteem and reported post-surgical dissatisfaction with outcomes.[39] A significant decline in self-esteem nine months post-surgery is mostly related to whether or not the patient is still wearing appliances. Differences between these results and others with respect to self-esteem at nine months are cited as due to use of a specific personality test (a variation of Fitts' Tennessee self-concept scale, FTSC) versus other authors' use of subjects' self-report.[37] Two years post-surgery, self-esteem rises, but not to pre-surgical levels. This may be due to elevated pre-surgical self-esteem from anticipation of surgical improvements.[38]

Flanary, Barnwell, VanSickels, Littlefield and Rugh[40] found a similar pattern of changes in self-esteem over twenty-four months using a scale similar to that used by Kiyak et al.[38] (FTSC, unmodified), but do not mention lower esteem at 24 months versus one to four weeks pre-surgery. Perhaps recommendations for such a patient should depend on the patient's long-term (2 years or more) satisfaction with treatment outcomes. In the present study, a vignette described a patient with initially low self-esteem, the rationale being that a respondent sensitive to self-esteem would not wish to decrease it further or have the patient experience post-surgical dissatisfaction.

Selective information search is a strategy intended to "...change the subjective representation of elements inherent in a threatening situation...".[41] Vigilance is a strategy to obtain threat-relevant information. Cognitive avoidance is a strategy to avoid threat-relevant information. An avoidant coping mechanism enhances post-surgical satisfaction whereas a vigilant coping mechanism results in greater post-surgical dissatisfaction in orthognathic patients.[42] The present study assessed respondents' anticipation of post-surgical psychological outcomes based on a hypothetical patient's vigilant or avoidant behaviour a few months pre-surgically.

Treatment recommendations from which respondents could choose for vignettes included the option to delay treatment decision. This option is reasonable since delay may avoid future psychiatric problems for the patient.[43]

In summary, review of literature pertaining to patient psyche resulted in examination of the influence of the following patient traits over orthodontists' decisions in borderline orthognathic surgery cases: age; temporal variation in treatment preference; traumatic versus developmental defect; projection of negative life events onto an orthodontic problem; realism of treatment expectations; external versus internal motivation; self-consistency of facial image; introversion versus extroversion; self-esteem; coping mechanism.

Hypotheses

The first seven hypotheses were considered the major hypotheses of the thesis and addressed the influence of orthodontists' own traits over their treatment recommendations to a hypothetical borderline orthognathic patient. Hypotheses 8 to 27 investigated the influence of various patient traits over orthodontists' recommendations. Hypotheses 28 to 30 and 31 to 33 addressed the influence of oral surgeon and psychologist traits respectively over orthodontists' treatment recommendations.

Major Hypotheses I: orthodontist traits.

H1 Is there a statistically significant effect of orthodontist level of experience, based primarily on orthodontic graduation year, on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

H_o1 There is no significant effect.

H_a1 There is a significant effect.

H2 Is there a statistically significant effect of oral surgeon availability (based on the oral surgeon to population ratio in a respondent's practice area, orthodontist subjective estimate of availability and orthodontist estimate of oral surgeon degree of busyness) on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

H_o2 There is no significant effect.

H_a2 There is a significant effect.

H3 Is there a statistically significant effect of orthodontist perception of orthognathic surgery as a financial burden (either to the patient or to their provincial health care system) on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

H_o3 There is no significant effect.

H_a3 There is a significant effect.

H4 Is there a statistically significant effect of orthodontist perception of cost justification for orthognathic surgery for varying degrees of functional or esthetic deficit on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

H_o4 There is no significant effect.

H_a4 There is a significant effect.

H5 Is there a statistically significant effect of orthodontist flexibility in changing treatment option mid-treatment in the event of patient pre-surgical anxiety on treatment options orthodontists recommend initially to the borderline orthognathic surgery patient?

H_o5 There is no significant effect.

H_a5 There is a significant effect.

H6 Is there a statistically significant effect of quality of orthodontist facial self-perception (based on self-assessment and self-report of assessment by another orthodontist) on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

$H_0 6$ There is no significant effect.

$H_a 6$ There is a significant effect.

H7 Is there a statistically significant effect of orthodontist anticipated level of psychological difficulty with the borderline orthognathic surgery patient on treatment options orthodontists recommend to such a patient?

$H_0 7$ There is no significant effect.

$H_a 7$ There is a significant effect.

Hypotheses II: patient physical traits.

H8 Is there a statistically significant effect of patient age on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

$H_0 8$ There is no significant effect.

$H_a 8$ There is a significant effect.

H9 Is there a statistically significant effect of patient systemic health on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

$H_0$9 There is no significant effect.

H_a9 There is a significant effect.

Hypotheses III: patient physical traits with psychological overtones.

H10 Is there a statistically significant effect of patient TMJ health on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

$H_0$10 There is no significant effect.

H_a10 There is a significant effect.

H11 Is there a statistically significant effect of patient existing excellent facial esthetics on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

$H_0$11 There is no significant effect.

H_a11 There is a significant effect.

H12 Is there a statistically significant effect of patient developmental versus traumatic defect on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

$H_0$12 There is no significant effect.

H_a12 There is a significant effect.

Hypotheses IV: patient attitude.

H13 Is there a statistically significant effect of patient cooperation on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

H_o13 There is no significant effect.

H_a13 There is a significant effect.

H14 Is there a statistically significant effect of patient tolerance of treatment-associated discomfort and inconvenience on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

H_o14 There is no significant effect.

H_a14 There is a significant effect.

H15 Is there a statistically significant effect of patient acceptance of treatment cost and time on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

H_o15 There is no significant effect.

H_a15 There is a significant effect.

H16 Is there a statistically significant effect of patient patience with respect to surgical delays on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

$H_0$16 There is no significant effect.

H_a16 There is a significant effect.

H17 Is there a statistically significant effect of patient seriousness of consideration of surgical risks on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

$H_0$17 There is no significant effect.

H_a17 There is a significant effect.

H18 Is there a statistically significant effect of patient fear of risks of general anaesthetic on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

$H_0$18 There is no significant effect.

H_a18 There is a significant effect.

H19 Is there a statistically significant effect of patient indecision regarding selection of treatment option on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

$H_0$19 There is no significant effect.

H_a19 There is a significant effect.

Hypotheses V: patient psyche.

H20 Is there a statistically significant effect of patient consistency of facial self-image on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

H_o20 There is no significant effect.

H_a20 There is a significant effect.

H21 Is there a statistically significant effect of quality of patient self-esteem on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

H_o21 There is no significant effect.

H_a21 There is a significant effect.

H22 Is there statistically significant agreement between the literature description of the quality of vigilant- or avoidant-coping patients' immediate post-surgical satisfaction and orthodontists' prediction of satisfaction?

H_o22 There is not significant agreement.

H_a22 There is significant agreement.

H23 Is there a statistically significant effect of patient external motivation on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

H_o23 There is no significant effect.

H_a23 There is a significant effect.

H24 Is there a statistically significant effect of patient projection of external life crises onto their physical defect on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

H_o24 There is no significant effect.

H_a24 There is a significant effect.

H25 Is there a statistically significant effect of patient introversion versus extroversion on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

H_o25 There is no significant effect.

H_a25 There is a significant effect.

Hypotheses VI: patient support system.

H26 Is there a statistically significant effect of lack of support for selected treatment option by patient support system on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

H_o26 There is no significant effect.

H_a26 There is a significant effect.

H27 Is there a statistically significant effect of patient facial similarity to family members on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

H_o27 There is no significant effect.

H_a27 There is a significant effect.

Hypotheses VII: oral surgeon traits.

H28 Is there a statistically significant effect of orthodontist perception of oral surgeon competence on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

H_o28 There is no significant effect.

H_a28 There is a significant effect.

H29 Is there a statistically significant effect of quality of orthodontist rapport with oral surgeon on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

H_o29 There is no significant effect.

H_a29 There is a significant effect.

H30 Is there a statistically significant effect of comprehensiveness of oral surgeon's explanation of surgical risks to patient on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

H_o30 There is no significant effect.

H_a30 There is a significant effect.

Hypotheses VIII: psychologist traits.

H31 Is there a statistically significant effect of orthodontist perception of psychologist availability on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

$H_0$31 There is no significant effect.

H_a31 There is a significant effect.

H32 Is there a statistically significant effect of orthodontist perception of psychologist expertise on treatment options orthodontists recommend to the borderline orthognathic surgery patient, particularly in situations where the orthodontist perceives need for psychological consultation?

$H_0$32 There is no significant effect.

H_a32 There is a significant effect.

H33 Is there a statistically significant effect of quality of rapport between psychologist and orthodontist on treatment options orthodontists recommend to the borderline orthognathic surgery patient?

$H_0$33 There is no significant effect.

H_a33 There is a significant effect.

II. MATERIALS AND METHODS

Generation of Hypotheses

Some hypotheses were generated using an ethnographic approach, which involves having an expert in the field of interest discuss their concerns regarding the pertinent issue in an open-ended interview. Other hypotheses were generated using a scholarly approach which involves review of pertinent literature. The advantage of this combined approach was representation of orthodontists' concerns rather than solely the author's. A limitation of the ethnographic approach is that concepts subjects report to be important to the issue may not correspond to those actually used in decision-making.[13] This limitation could be refuted in some cases (eg. introversion, extroversion, realism of expectations) in which similar hypotheses were generated by both ethnographic and scholarly approaches.

The author conducted a personal interview of four orthodontic graduate students and one orthodontic faculty member at the University of Alberta. A second orthodontic faculty member reviewed items generated by the first five subjects. Table I summarizes ethnographic subjects' professional backgrounds. Ethnographic subjects were asked to discuss factors which would influence their decision to recommend surgery to a borderline orthognathic patient. The questions were open-ended, and if responses were vague, subjects were prompted with phrases such as "Which qualities of the patient would influence the treatment options you offered them? Which qualities of orthodontists do you think influence the treatment they would offer a borderline orthognathic surgery patient? Which qualities of the oral surgeon would influence your decision to offer a patient the surgical option? Which qualities of the patient would make them good or poor surgical candidates?" Appendix I contains results of the ethnographic survey, with comments applied to the present study emphasized using bold letters.

Table I. Ethnographic Survey Subject Profile

Subject	Background
1	full-time orthodontic faculty member; 5 years part-time clinical practice; M. Sc.
2	3rd year orthodontic graduate student (M. Sc. program)
3	1st year orthodontic graduate student (M. Sc. program)
4	2nd year orthodontic graduate student (M. Sc. program)
5	2nd year orthodontic graduate student (M. Sc. program)
6	full-time orthodontic faculty member; 11 years part-time clinical practice; M. Sc.

Scholarly generation of hypotheses involved broad scope review of orthognathic, plastic surgery and medical literature to determine traits of patients which make them good or poor risks for appearance-altering surgery and traits of treatment providers which potentially influence their decision-making.

The author's own interests were represented by hypotheses concerning application of self-consistency theory to the orthodontist, investigation of the influence of patient existing excellent facial esthetics over orthodontists' treatment recommendations, and examination of orthodontist utilization of psychological services.

Decision Methodology

The descriptive approach taken with this research was warranted. Before making recommendations regarding a rational decision-making model one must determine influences over decision-making.

Vignette studies preclude subject reluctance to think aloud in the patient's presence.[44] Also, linear decision models generated from vignette studies are more accurate in predicting response to new cases than strategies of equal weighting of variables or self-report.[13] Some studies show the three techniques as unable to predict responses to new cases as well as models calculated from actual clinical cases whereas other studies show that responses to vignettes resemble those made with actual patients.[13] A vignette study was deemed appropriate for this initial investigation of borderline orthognathic decision-making.

By definition, a single-system case is one for which only the decision is of interest, not its accuracy. A double-system case allows evaluation of accuracy since decision outcomes are known.[45] In the present descriptive study, a single-system approach predominated. Double-system orientation occurred where respondents' decisions were compared to what psychological literature indicates to be sound decision-making. Actual clinical outcomes were unknown, so double-system analyses required cautious interpretation.

Pre-test Procedures

A mail survey was chosen over telephone or personal interview due to sampling situation, convenience and expense. "...[Researchers] have found that most survey estimates are unaffected by the mode of data collection".[46]

The pre-test consisted of a draft questionnaire answered by three subjects, all respected local orthodontists. Selection of local orthodontists facilitated meeting to discuss item design directly. Selection of a larger sample[46] locally might have impaired response rate to the actual questionnaire since local orthodontists would be most likely to participate in the study.

The pre-test sample was fairly representative of the general orthodontic population.[47] It was stratified with respect to years of clinical experience, age, teaching commitments, academic degrees and hours spent in academia versus clinical practice. Table II profiles pre-test subject professional background.

The two subjects at the extremes of experience responded to the draft questionnaire at the same sitting. The subject with 13 years clinical experience responded in a separate sitting. The subjects were instructed to respond to the questionnaire as if they had just received it in the mail.

Table II. Pre-test Subject Profile

Subject/ Response Time	Background
1/ 50 min	M.S.; 29 years clinical orthodontics; 29 years part-time dental undergraduate instructor; 21 years part-time orthodontic graduate instructor; age 61
2/ 36 min	M. Sc.; 13 years clinical orthodontics; 2 years full-time orthodontic graduate and dental undergraduate instructor; 12 years part-time orthodontic graduate and dental undergraduate lecturer; age 42
3/ 36 min	Dip. Ortho; 5 years clinical orthodontics; 5 years part-time undergraduate clinical instructor; age 33

Interaction between subjects and author was minimal during the pre-test. As close a simulation as possible to the proposed design was made in order to accurately assess the questionnaire as a research instrument. Exceptions to this were that subjects were not given field materials and they were encouraged to write comments in the margins of the questionnaire so that difficulties with items could be remembered for the follow-up discussion.[46]

Questionnaire length was estimated by having subjects record their response start and completion times (Table II). This estimate was likely quite accurate since underestimation of time subjects might have wanted to report would have been offset by their attempt to be meticulous in their responses. No subject felt that the questionnaire was so time-consuming as to discourage response, and longer academic surveys have been reported.[46]

Immediately following draft questionnaire completion, individual items were discussed at length to enable clarification of difficulty, ambiguity or inapplicability. Discussion proved to be an additional measure for validation of ethnographically-generated hypotheses. One thesis committee member familiar with survey methodology and the author took part in the discussion with the two subjects of the first sitting then a week later with the third subject. To the author's knowledge, there was no discussion between subjects regarding details of the pre-test before the third subject was tested. Pre-test subjects were asked to keep details of the pre-test confidential to avoid influencing their colleagues who were part of the sample frame. Based on the combined opinions of pre-test subjects, author and thesis committee member, the draft questionnaire was revised. Final revision to the research instrument followed review by author and the three thesis committee members.

Ethical Considerations

The most important ethical considerations for respondents were likely confidentiality and informed consent. To maintain confidentiality, potential respondents were assigned a three digit identification (ID) number. This ID number was placed on every page of the corresponding questionnaire and was the means by which need for follow-up could be assessed. Prospective respondents who had not returned a questionnaire within one month were identified by their number and sent the second follow-up. Use of ID number versus name avoided biasing the data entry technician (the author), who knew few of the respondents personally anyway. The ID number also ensured that if questionnaire pages became separated they could be rejoined and items entered as the response of a single person, allowing grouping of data across responses. Retrospectively, ID number proved useful for those respondents who entered postal codes for which no location could be found in the reference material. A considerable number of discrepancies were noted between reported postal codes and the corresponding mailing addresses. Therefore, ID numbers were cross-checked against mailing address for the entire sample.

Only the author and the three thesis committee members were anticipated to have access to data linking respondent ID number to name. All four signed a commitment to confidentiality (Appendix II) prior to questionnaire mail-out. The author kept lists which linked ID number to respondent name. Thesis committee members never requested access to such lists. Data entry verifiers did not have such access. Destruction of the cross-reference lists will occur upon completion of the study.

A variety of informed consent can be obtained in mail surveys while maintaining the confidentiality of respondents (not having them sign a consent form) and while keeping respondents' knowledge of the precise nature of the study vague. This variety of consent necessitated informing respondents of several issues:[46] the study was being done under the auspices of the University of Alberta; the sponsor was the McIntyre Fund; application had been made to the Canadian Fund for the Advancement of Orthodontics for additional funding; briefly, the purpose of the study; confidentiality measures; that cooperation was voluntary; and their freedom to leave individual items unanswered. Details of this information can be found in Appendix III, the introductory letter to the first mail-out.

Prior to data collection, the Director of Graduate Studies and Research at the Faculty of Dentistry approved the questionnaire in its final format (Appendix IV) with respect to human rights issues, having been made aware of intended confidentiality measures. There was thesis committee consensus that the questionnaire was not of a highly personal or sensitive nature. No objections were raised by the pre-test subjects with respect to questionnaire content, which was not changed significantly from pre-test to final draft.

Questionnaire Item Design

The final questionnaire consisted of 63 items. The 23 vignettes, together with 5 other items, constituted a moderate sample of schematic items[45] (i.e. conceptual decompositions of the object of the decision). There was a similarly moderate sample of direct questions. Vignettes described patients with the physical, psychological, attitudinal, and support system traits of interest under the hypotheses.

Vignettes were generally constructed with seven closed options and one open option, any or all of which the respondent could choose (multi-response). Restriction to eight options kept task difficulty reasonable. Closed items were favoured due to the self-administered format of the questionnaire. The open option allowed freedom of response where closed options were perceived by respondents as restrictive.[46]

Vignettes were phrased as similarly as possible with the exception of the unique patient characteristic. All vignette patients were described as having a "borderline skeletal discrepancy which could be treated either with camouflage orthodontics or combined orthodontics and orthognathic surgery". "Either" and "or" were underlined to emphasize the borderline nature of the case. The unique characteristic was underlined to speed reading of the questionnaire and facilitate comprehension by the respondent.

Nineteen of 23 vignettes had identical response options. Vignette response options included major treatment options (surgery, camouflage, and no treatment) and minor treatment options (delay decision, refer to dental specialist, refer for second orthodontic opinion, refer for psychological consultation). Treatment options were expressed in the same order for vignettes with identical options.

Non-vignettes were closed, single-response items, which have the advantage of forcing definitive response.[46] Scaled options used either a four- or five-point scale, depending upon what fit most logically with the particular item. Where appropriate, a "don't know" option was included.

Contingency items were minimized with the exception of responses specific to satellite practices. For items referring to oral surgeon or psychologist availability, respondents could answer for both principal and satellite offices. Although responses to satellite options were not analyzed, this contingency enabled respondents to describe the principal office without confusing the description with traits of possible satellites.

Response categories were as exhaustive, mutually exclusive, and logically arranged as possible. Phraseology was as unbiased and unambiguous as possible. To avoid confusion, a restricted number of item formats were used.[46] Optional wording was enclosed within parentheses.

Questionnaire Construction

The cross-sectional questionnaire design was deemed appropriate for a study of a preliminary nature. The disadvantages of a cross-sectional design[48] were outweighed in the present study by the advantage of convenience.

After a general introduction and instructions to the respondent, the questionnaire was subdivided into nine sections, each with its own introduction.[47] Introductory or instructive comments were concise, vague with respect to purpose and made noticeable using UPPER CASE or **bold** characters.[46] Questionnaire sections addressed:

- orthodontist facial appearance (A),
- perception of surgical cost (B),
- age limits on orthognathic surgery and growth modification (C),
- treatment recommendations for most vignettes (D),
- treatment recommendations for support system vignettes (E),
- treatment of the anxious pre-surgical patient and perception of cognitive coping mechanisms (F),
- traits of oral surgeons (G),
- traits of psychologists (H),
- demographic traits of respondents (I).

Non-random order of items was intended to reduce confusion by focusing directly on one stimulus before switching to another, the rationale being that respondents were perceptive enough to recognize randomizing manipulations. General questions preceded related specific questions, with specificity preferred.

Questionnaire format was uncluttered to enhance readability for response and data entry.

To avoid acquiescence bias (respondent tendency to agree or disagree regardless of item content)[48], items were expressed as neutrally as possible and response options were ordered essentially alternating the positive and negative extremes for consecutive scaled items. Logical opposites were used only twice (i.e. introverted versus extroverted vignette and vigilant versus avoidant coper). This detracted from acquiescence assessment, but to include a logical opposite for every item would have made the questionnaire too cumbersome.

To encourage response by capturing subjects' interest early, the questionnaire started with the section regarding orthodontists' own facial esthetics and personal experience with orthodontics. This section was easy to answer and the orthodontists were likely to have an interest in themselves. Demographic questions were placed last to avoid early perception that the questionnaire was tedious.[49,50]

The questionnaire was printed on paper of a medium green hue. Although this is not guaranteed to increase response rate,[51] it was felt likely to capture respondents' attention.

Sampling Procedures

The study intended to investigate differences between respondent sub-samples. To enhance sub-sample sizes despite anticipated non-response, the sample frame consisted of the population of licensed Canadian orthodontists as listed in 1991 by the ten provincial registrars. In the few provinces where lists were not computer-updated, the population was small enough that registrars' staff knew personally of recent additions. The large respondent sample was consistent with social judgement and psychological decision theory designs.[45]

Limitations of licensing lists included errors in addresses and inclusion of retired orthodontists who maintain licensure after retirement. The only certified specialists (2) who practised in the territories were also licensed in other Canadian provinces. In order not to include territorial respondents twice, provincial registrars' lists alone were used. Territorial respondents could distinguish their territorial satellites in the contingency items.

Six potential subjects excluded were two thesis committee members, three pre-test subjects and one subject who inadvertently became aware of the purpose of the study prior to responding to the questionnaire. Exclusion on the basis of familiarity with the purpose of the study was consistent with the experimental technique of minimally informing subjects as to purpose.[46]

Data Collection and Field Procedures

Field procedures are techniques used to maximize response[46] and thus minimize non-response bias. An introductory letter and questionnaire constituted the initial mail-out. The first follow-up was a postcard[51] (Appendix V) mailed one week after the initial mail-out. The second follow-up consisted of another letter (Appendix VI) and questionnaire mailed three weeks after the postcard. During the entire mail-out period (starting September, 1991) and into a portion of the response period (ending February, 1992), the postal situation was unstable due to rotating Canada-wide strikes or threats of strikes.

The introductory letter to the initial mail-out requested potential respondents' participation, emphasized the need for a large response and positively reinforced response by representing it as a contribution to the orthodontic profession. The 45 minute estimated completion time was based on a mean 41 minute response time to the draft questionnaire, plus one minute for each of four additional questions in the final questionnaire. (The additional four questions were simple demographic items.) This letter also included a description of confidentiality measures anticipated to increase subjects' willingness to participate.

Inclusion of the university crest on all mail-outs, by indicating university sponsorship, was hoped to enhance response rate.[51,52]

Various techniques were used to personalize communications with potential respondents and thus increase response rate. The introductory letter and second follow-up letter were signed by the author using green ink.[53] Envelopes mailed to respondents, return envelopes and the postcard were hand-addressed using an attention-grabbing thick black (usually calligraphic) felt pen. Word-processed address stickers were used only on the return envelopes for the second follow-up. Stamps rather than metered postage were used:[51] single stamps for less expensive mail-outs such as the postcard and return envelopes, multiple stamps for first and third mail-outs. Multiple stamps were necessary since no stamp with exact postage was available, and possibly advantageous since the large number of stamps on the envelope would help potential respondents appreciate the cost of the study.

The postcard was intended to remind non-respondents to return their questionnaire and thank respondents for their participation. The thank you was a form of positive social reinforcement for as-yet non-respondents.[51]

Shortly after the postcard was mailed, some mail-outs were returned with wrong address notification. Such addresses were double-checked with the appropriate registrar. Where an address had changed, a questionnaire, initial cover letter and personalized note were sent to the potential respondent to explain the situation. Where no new address could be obtained, the second follow-up was mailed with those for the as-yet non-respondents. For 'wrong-address' correspondence returned around the time of the second follow-up, a new questionnaire was sent, but not a follow-up questionnaire.

Necessity for a costly third follow-up by telephone was only to be considered if total response was less than 60%. With a response rate over 60%, telephone follow-up was not deemed necessary.[47]

Data Entry

Questionnaire items were coded for ease of computer data entry. Single-response items were coded in single digits where possible with '1' as the most positive extreme of scaled items. Missing items were coded '9', 'don't know' was coded '7', numeric values were entered directly.

A 'z' variable was assigned to every item to indicate presence of comments for that item. Visual survey of returned questionnaires determined the most frequent comments. These were coded and a second data entry pass performed for the sole purpose of recording comments, with eighty-five characters allowed. Illegible or ambiguous comments were not entered verbatim. When 85 characters was insufficient, the comments were abbreviated using key words. Comment data was not reliable for analysis beyond summary statistics due to the necessity for abbreviation. Re-entry with a greater allowance for character length would have to be done, although the results would still be best treated as anecdotal.[46]

Each questionnaire section was coded for 'non-response' comments. Some respondents returned questionnaires partly answered or unanswered, but generally if the questionnaire was returned there was a comment as to the reason for non-response.

The date of receipt of the questionnaire by the investigator was also entered.

Anomalies in response required special consideration for data entry. When respondents indicated multiple responses for a single-response item, the most extreme option in the context of the question was recorded. For example, in the item regarding the earliest feasible age for orthognathic surgery, if two ages were checked, the youngest of these was taken. If this approach seemed to misrepresent a respondent's intention the item was classified as missing, the rationale being that results would suffer greater invalidation through misinterpretation than through non-inclusion. If a respondent checked multiple answers, but in their written comments indicated that they preferred one of the answers, the code for the preferred answer was entered. If one of the two options checked in a single-response item was "don't know", "don't know" was taken as predominant and entered. Some respondents put numbers in the boxes beside the multi-response options rather than just checking them. This may have been intended to indicate an order of preference, although respondents did not state this in most cases. Such numbers were classified as comments but were addressed no further.

Data were entered on an IBM-compatible computer using SPSS Data Entry II.[54] Prior to entry, variables were defined with respect to name, label, type, length, and missing values. 'Skip and fill' rules were mainly used for 'non-response' situations so that missing values could be assigned to all items in a section with one key stroke. Valid entries under range rules included values previously defined under value labels. Range rules screened gross typographical errors, but not errors involving substitution of allowable values. Logical rules to screen responses contingent on respondent attributes were contraindicated since the author did not want to make assumptions regarding response styles. The data did not lend themselves to the use of logical rules.

Data were entered by questionnaire section. The advantage to this was that any problems within a section regarding range rules or variable definitions became apparent early and could be corrected before too many questionnaires had been entered.

Data Entry Verification

In order to verify the accuracy of data entry by the author, two independent data verification technicians were chosen on the basis of convenience and their anticipated accuracy in completing the task. Both received explicit instructions regarding coding scheme and data entry conventions described previously.

From a random numbers table,[55] 67 numbers with values between 1 and 334 were generated, representing 20% of the 334 respondents. These numbers were used as data entry case numbers and matched to the corresponding respondent ID number. The 67 questionnaires thus selected were divided into a group of 34 and a group of 33. Printouts of the entire data entry for each group were checked against the corresponding questionnaires and discrepancies noted. Discrepancies were reviewed with the author to ensure accuracy of data entry verification, particularly where there was a question of interpretation. Discrepant data were re-entered for the 20% of the sample for which data were verified.

Data entry accuracy was evaluated by calculating percent discrepancy between data entered and data verified. An acceptable result (less than 1%) reinforced the decision not to perform key verification[46] or data verification of the remaining 80% of respondents.

Elaboration on Demographic Data

Certain data had to be extrapolated from respondent location. These included population of the area of principal practice, number of oral surgeons and psychologists practising in the area, actual costs of orthognathic surgical procedures and the proportion of such costs covered by the appropriate provincial health care organization.

Visual data edit and preliminary matching of postal code item to area name revealed inaccuracy of reporting of the first three postal code digits. To improve accuracy, ID number was referenced back to mailing address.

Population data (1991) were available from Statistics Canada for Census Subdivisions (CSD's),[56] Census

Agglomerations (CA's) and Census Metropolitan Areas (CMA's)[57] associated with the mailing address of most respondents. CSD is a basic category which includes subclassifications city and town, but excludes commuter region population. CA and CMA, differentiated by size, define "...large urban cores with their adjacent urban and rural areas with which they have a high level of economic and social integration."[57] Some respondents practised in areas with no associated commuter region. Therefore, one analysis was performed on core population using CSD data and one analysis was performed on core plus commuter population using CA and CMA data, or CSD data in the event of no associated commuter population.

Sources of error for respondent population data applied to Hypothesis 2 included missing data for sparsely populated areas and limitations inherent in census data[58].

To determine the number of oral surgeons in a respondent's practice area, 1991 registrars' lists for orthodontists and oral surgeons were obtained concurrently. An oral surgeon-to-population ratio was calculated and matched to respondents based on mailing address.

To determine the number of available psychologists in a respondent's practice area, ratios of provincial population to registered or licensed psychologist were obtained from a reference whose data are obtained from professional associations, Statistics Canada, commercial companies and educational institutions.[59] This method was not very accurate since psychologist distribution may vary considerably from one area of a province to another and only outdated data were available. These compromises were considered acceptable for two reasons: first, in every province, psychologists are likely more numerous in more populated areas and provinces may be similar with respect to this distributional generalization; second, psychologist utilization was low, so a rough estimate was not predicted to alter the conclusions.

Finally, verification of the accuracy of responses regarding costs of and funding for orthognathic surgical procedures was accomplished using a survey of one oral surgeon from each Canadian province (Appendix VII). Oral surgeons were recommended by the president of the Canadian Association of Oral Surgeons. Their responses should have been accurate since they charge patients for surgical procedures regularly. One potential inaccuracy relates to coverage for genioplasty. In some provinces this was funded as a functional but not as an esthetic procedure. Despite this, some respondents classified the procedure arbitrarily as either funded or not regardless of procedural motivation.

Statistical Methodology

Data were analyzed using SPSS/PC+ version 4.0, SPSS^X, procedure UANOVA available at the University of Alberta and manual calculations of *t*-tests and chi-square (X^2).

Testing the Instrument.

Cronbach's alpha reliability test[60] was applied to larger sections of the questionnaire (A, B, D, E) which contained groups of similar questions for which internal consistency was thought to be an issue.

Specific validity tests were done for some items. One such test was that of the accuracy with which respondents knew the costs of surgery when they purported to have such knowledge, expressed as percent agreement between orthodontists' and oral surgeons' responses to essentially the same items. Oral surgeons' responses were obtained in the previously described mini-survey. This test of accuracy enabled evaluation of the validity of tests for hypotheses three and four.

Another specific validity issue which was examined was the accuracy of items involving orthodontists' assessment of the traits of the oral surgeons to whom they refer their orthognathic cases. This test of accuracy enabled evaluation of the validity of tests for hypotheses 2, 28, 29, 30.

Describing the Sample.

The only respondent demographic trait which could be verified for the entire sample frame was location. Year of completion of orthodontic graduate training could be determined for sample frame members who were also members of the Canadian Association of Orthodontists (CAO), using that organization's directory.[61,62] Principal language was included on the Quebec registrar's list, but without indication as to whether respondents were uni- or bilingual.

To ascertain whether respondents differed from the sample frame sufficiently to cause non-response bias, graduation cohorts were compared to frame with respect to response rate using a X^2 analysis.

To assess acquiescence bias, ranking items (B1-4,6,7; C1,2,3,option O; F1,2; G1,6,8,9; H1,3-8) were recoded as high, moderate and low. For example, "very good" and "good" both coded high by virtue of being at the positive extreme of a ranking scheme. For 4-option ranking items, "fair" was coded as moderate despite a possible positive connotation. Means of the newly created indicator of acquiescence were obtained for each section then correlated (Pearson's r) between sections. With this manipulation, degree of yea- or nay-saying could be compared between items designed to test different concepts. The alternative of crosstabulations of logical response combinations was rejected because it seemed to require too many subjective, possibly invalid assumptions regarding item interaction.

Early- versus late-responder bias was not assessed, the rationale being that reasons for non-response were unlikely to be related to trends in treatment recommendation. In addition, such a test would have had poor validity given the possible influence of postal strikes over response time.

Mean and range were calculated for respondent age, years in practice, and age at graduation. Range was calculated for practice area population.

Testing Hypotheses.

Consistent with an approach recommended for determination of medical decision models based on discrete variables[13] and used in circumstances similar to those of the present study,[9] analysis of variance (ANOVA) was applied to tests of major hypotheses. A test of the ANOVA assumption of random sampling from a normal population of constant variance was deemed unnecessary.[60] Greenhouse-Geiser adjusted output helped guard against violation of assumptions.[63] Use of highly significant probabilities for the ANOVA ($P < .001$) guarded against incorrect rejection of null hypotheses in situations involving many comparisons.[63]

The Type I error rate (α) was fixed at .05 with two exceptions: the exception for ANOVA (excluding multiple comparisons) already mentioned and expression of *t*-test results in terms of the highest applicable probability despite use of .05 as baseline for significance.

The ANOVA model involved the 19 same-format vignettes to avoid validity problems. In the event of significant main effects, multivariate tests of significance were followed with univariate *F*-tests. Pillai's trace was emphasized as the most powerful and robust of the multivariate tests. Where significant interaction occurred, multiple comparisons of pertinent least squared means (LSQ-means) were performed using the generally accepted α of 0.05.

Where data were grouped for hypothesis testing, a nomothetic approach was often used. This refers to grouping data across respondents before grouping across responses. The nomothetic method assumes similarity of respondents and by aggregation across them can increase the reliability and thus the power of a test.[45] Group analyses can mask model discrepancies for individual subjects but such discrepancies are small and with no significant trends.[45] Group weighting has been shown to be reproducible and predictive in some marketing research and medical studies.[13]

Hypothesis 1 analyses focused on graduation year rather than birth year due to the similarity between the two measures. Also, graduation year represented experience more accurately in concept than birth year did.

Graduation year was analyzed with variables grouped nomothetically (across graduation cohorts 1950-61, 1962-71, 1972-81, 1982-86, 1987-91; interval data grouped ordinally). The interval defining the most recent cohort, although responsible for the similarly small interval of the second-most-recent cohort, was deemed appropriate since those with less than five years experience in clinical practice would not have had the opportunity to observe long-term treatment effects.

Hypothesis 2 tested objective and subjective (G1P, G3P, G5P; ordinal, interval) measures of oral surgeon availability separately. Data were grouped nomothetically (ordinal groups) for the objective measure, which was computed by division of respondent practice area population (by CSD or CSD/CA/CMA) by the number of oral surgeons listed as practising in that area. Of the population:oral surgeon groups for CSD, the 50,000-59,999 and 100,000-300,000 groups held the smallest number of respondents at less than 5% of the total 321 valid cases. Groupings for CSD/CA/CMA by increments of 10,000 accommodated the large Toronto sub-sample but resulted in some relatively small sub-samples.

Hypothesis 3 data (ordinal) pertained to the influence over treatment recommendation of perception of orthognathic surgery as a financial burden. These data were not grouped. The rationale for treatment of Hypothesis 3 data is elaborated upon later since results of preliminary analyses affected methodological decisions.

Data for Hypotheses 4 and 5 (ordinal and nominal respectively) were not grouped. These hypotheses pertained to perception of cost justification for surgery for varying degrees of functional or esthetic deficit and orthodontist flexibility in changing treatment option mid-treatment for the anxious patient. Grouping cases would not have significantly equalized most sub-sample sizes, was sometimes conceptually contraindicated and was deemed unnecessary where two-way interactions were nonsignificant. Note that responses to item B3 under Hypothesis 4 were subjected to Pearson's correlations in order to give insight to the results of the ANOVA.

Hypothesis 6 data (ordinal/nominal) were grouped only for orthodontists' facial self-evaluation under item A1. In order to maintain reasonable sample size for response categories, two groups included "very attractive" or "attractive" and "generally attractive with more than one unattractive feature", "unattractive" or "very unattractive". "Generally attractive with one unattractive feature" formed its own group.

Data (interval) were grouped (ordinally) as follows for Hypothesis 7. For the 19 same-format vignettes and one vignette (F3) which offered the major treatment options and psychological referral option, the total number of psychological referrals was computed. Data were grouped into a three-point scale: respondents making no psychological referrals, those making one or two referrals, and those making more than two referrals.

Two objective methods existed for testing hypotheses pertaining to the influence of patient trait over treatment recommendation: multiple comparisons and *t*-tests. Multiple comparisons were made between recommendations of the three 'major' options-- surgery, camouflage, and no treatment-- for vignette traits included in the ANOVA model (Hypotheses 9, 13-18, 20, 21, 23, 24, 26, 27). For paired items examining one trait, major and minor treatment options were subjected to multiple comparisons (Hypotheses 12, 25). Valid percent responses for vignettes not included in the ANOVA model were submitted to *t*-tests of differences between means for an assumed-normally distributed population of unknown variance (Hypotheses 8, 10, 11, 19, 22). The *t*-test was deemed appropriate for what could be considered enumeration data.[64]

Subjective evaluation of treatment recommendation involved grouping respondents' combined frequencies of selection of the major options. Response combinations were regarded as restrictive when only one of either surgery or camouflage were chosen and non-restrictive if both surgery and camouflage were chosen. Results were expressed in terms of computed valid percent response -- the 'influence factor'. Despite the subjective nature of this test, it was thought worthy of inclusion.

For Hypothesis 22, frequencies of responses were compiled into that response consistent with or those responses inconsistent with literature describing the influence of vigilant or avoidant coping over post-surgical satisfaction. The consistent response was "poor" for vigilance and "good" for avoidance. The inconsistent responses were "very good", "good", "average", and "don't know" for vigilance and "average", "poor", "very poor" and "don't know" for avoidance. "Very poor" and "very good" were not tabulated for the vigilant and avoidant coping patient respectively since these extremes were not included in the literature description of post-surgical satisfaction.

Hypotheses 28, 29, 31, 32, and 33, related to the influence of oral surgeon and psychologist traits over treatment recommendation, were not tested beyond valid cumulative percent since results were obviously not in need of further testing. For these hypotheses, where valid cumulative percentages do not total 100 there were missing cases or responses had to be omitted due to inappropriate response to more than one item.

Two variables under Hypothesis 30, related to the influence of the quality of the oral surgeon's risks discussion with patients over orthodontists' treatment recommendation, were subjected to ANOVA. These variables were responded to with significantly different frequencies and had adequate sample sizes for analysis.

III. RESULTS

Data Entry Verification

Error expressed as percent discrepancy between data entry printout and actual response was 0.0003% for the 67 questionnaires reviewed by both data entry verifiers. All errors involved failure to indicate that a respondent had commented on an item in section D. One error involved a comment irrelevant to the hypotheses: omission of respondent comment "oral surgeon" beside D3E. One error resulted from non-entry of a comment (item D3) due to illegibility. One error was due to late definition of a data entry convention: the subject had numbered item D3 selections, which was not recorded as a comment on ranked preference as it was in similar circumstances later in the data entry process. There were three omissions of comments potentially meaningful to the results. A comment "Does he have a malocclusion?", indicating vagueness of patient description regarding item D9, was omitted. Also, comments by two subjects were omitted regarding a "P" versus "Q" substitution error in item D17. The 'meaningful' error level based on these errors was 0.00009%. However, such errors may have been rectified during the second data entry run for comments only. If comments were considered anecdotal, the error rate was essentially zero for the 20% of questionnaires tested. Errors by data entry verifiers were not calculated.

Response Rate

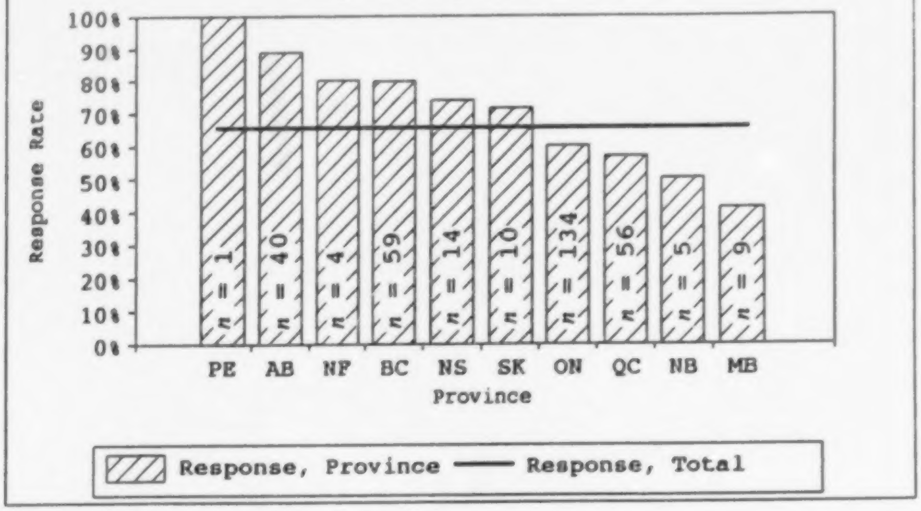
All responses (334) were received within five months following the initial mail-out. Initial mail-outs totalled 515, 7 of which were returned due to wrong addresses. One postcard was returned for the same reason. Of the wrong addresses, all but three of the involved orthodontists eventually responded. 'Effective' mail-out was thus 515 less the 3 wrong addresses.

Response rate was lower than calculated (334/512=65.2%) due to partially completed returns. Discounting partial-respondents, sample size by item totalled from 291 to 316. Sample size by section exceeded 300 in all but sections G and H. A mean 40.0% of partial-respondents or respondents who returned the questionnaire unanswered excused themselves based on retirement, 14.3% on busyness, and 9.0% on dislike of questionnaire design. The balance of respondents gave a variety of less frequent reasons.

The probability of respondent selection (0.64) equalled unity less the non-response fraction (0.35) less the pre-test and committee fractions (0.0096) and possibly less the strictly francophone fraction (not ascertainable).

Response rate by province, as a matter of general interest, is included in Figure 1.

Figure 1.
Response by Province



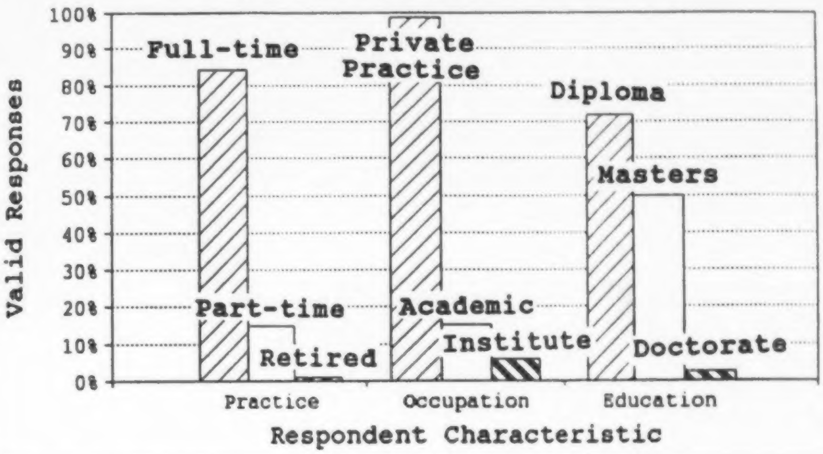
Respondent Profile

Respondent traits are shown in Table III and Figure 2. Note that in Table III mean population was not considered meaningful and therefore not included. Missing age data reflect non-response while missing population data reflect locations for which data were unavailable.

Table III. Respondent Age, Practice Area Population

Trait	*n* (valid)	*m*	range
Birth year	304	1945	1922-1963
Graduation Year	306	1976	1950-1991
Age at Graduation	304	30.9	25-48
CSD Population (1991)	328		2,141-1,017,666
CA/CMA Population (1991)	328		5,273-3,893,046

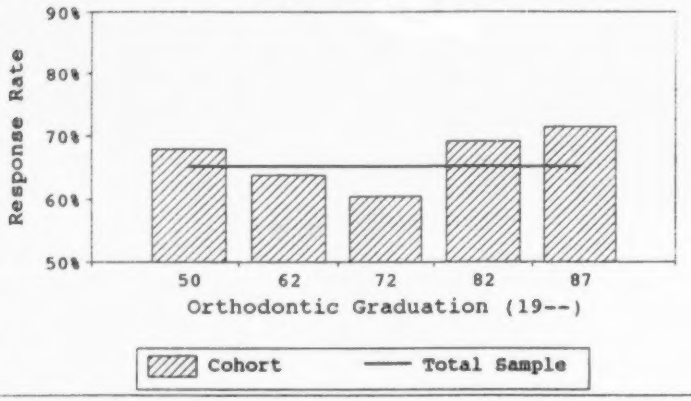
Figure 2.
Respondent Occupation/Education



Non-Response Bias

To assess bias, cohort response rate was compared to overall response rate for orthodontists for whom graduation year could be determined objectively. Objective determination involved matching respondent to graduation year as published in the CAO directory (1990-1992, verified with 1992-1994)[61,62]. Missing data included 10 CAO members with unpublished graduation year, 9 apparent non-member orthodontists, and 2 respondents who removed their ID numbers from the questionnaire. Cohort response rates illustrated in Figure 3 were subjected to a X^2 test. None differed significantly from the overall rate (*df* 1, $P < .05$). Note the nonsignificant ANOVA *F*-ratio for graduation year in Table VII, further indication of no significant difference in response rate between the five graduation groups.

Figure 3.
Response by Cohort



Tests of Questionnaire Reliability and Validity

Cronbach's alpha reliability coefficients for sections A, B, D and E respectively were -1.7229, 0.1926, 0.9036 and 0.7237 (*n* $\geq$ 290 per section).

As shown in Table IV, the only significant correlation between acquiescence indices was that between indices for sections B and C.

Table IV. Correlation Between Sectional Acquiescence Indices

	Acquiescence Index Taken from Questionnaire Sections _,_					
	B,C	B,G	B,H	C,G	C,H	G,H
r	-0.1834	-0.0245	-0.0206	0.0016	0.0806	0.0390
n	316	311	307	311	307	307
P	.001*	.334	.360	.489	.079	.248

By testing the accuracy with which respondents knew costs of surgery when they purported to have such knowledge one could test the validity of items pertaining to Hypotheses

3 and 4. Tables V and VI present comparisons of reports by respondents versus by an oral surgeon from the same province, expressed as percent agreement between the two specialties with respect to procedure covered or proportion of cost covered.

In five of ten provinces, almost 100% of the cost of surgery is paid for by provincial health care organizations. According to comments by oral surgeons who responded to the mini-survey, the patient or their private dental insurance company may pay the oral surgeon an extra $200-500 for in-office procedures. In the other five provinces where provincial coverage is not as extensive, the patient may pay an additional $2000-3000, depending on the nature and extent of the surgical procedure.

Note that genioplasty in Nova Scotia, Ontario and Quebec was funded for functional but not esthetic reasons. For these respondents, 'funded' or 'not funded' were both accepted as correct. The genioplasty item was thus limited in accuracy.

Validity with respect to accuracy of orthodontists' assessment of oral surgeons' traits created author concern due to potential for referral to more than one surgeon. Of respondents, 95.1% and 97.1% in principal and satellite practices respectively reported referral to a 'small' group of oral surgeons. Referral to a small group, whether due to lack of availability of oral surgeons or selection of oral surgeons based on a narrow range of traits, diminishes conflict in response. Although 'small' was not defined, it was deemed to engender sufficient accuracy.

Table V. Agreement Between Reports by Orthodontists and Oral Surgeons Regarding Provincial Health Care Coverage for Orthognathic Surgery-Related Procedures

Procedure Covered	% Agreement
2 Jaw Osteotomy	72
1 Jaw Osteotomy	62
Genioplasty	*83
G.A.	65
Additional G.A.	35
Other Components	73
No Component	98

Note. * = uncertainty due to functional vs esthetic definition; G.A. = general anaesthetic; *n* = 309.

Table VI. Agreement Between Reports by Orthodontists and Oral Surgeons Regarding Proportion of Orthognathic Surgery-Related Procedures Covered by Provincial Health Care

Proportion Covered	% Agreement
don't know	0
0%	0
<50%	19
50%	7
>50%	11
100%	78

Note. *n* = 309.

Tests of Hypotheses

To interpret results presented in the following sections, Appendix IV contains questionnaire item labels which correspond to variable labels, Table XIII gives vignette abbreviations, Figures 14 to 16 illustrate by vignette percent valid selection of major treatment recommendations (surgery, camouflage, no treatment), and Appendix VIII illustrates percent valid selection of minor recommendations (delay decision, refer to another dental specialist, refer for a second orthodontic opinion, refer to a psychologist). Note that the multi-response nature of vignettes led to combined percent valid responses in excess of 100.

Conceptually, the ANOVA interaction between hypothesis term (orthodontist's trait) and treatment recommendation addressed major hypotheses. Despite greater difficulty of interpretation of three-way interactions or lack of direct relevance to hypotheses, they are presented in ANOVA summaries or LSQ-means tables where informative.

Tests of Major Hypotheses: Orthodontist Traits

F-ratios and their corresponding probabilities for significant two-way interactions between orthodontist trait and treatment option are presented for quick reference in Table VII. ANOVA summaries for individual hypotheses are included in Appendices IX to XVI.

Table VII. ANOVA F-ratio Summary for Major, Significant Hypotheses

$H_{o/a}$	Main Effect/ Interaction Term	*F*-ratio	*P*
H_1	Graduation Year (GY)	4.54	0.00144
	Treatment Option (T)	288.77	0.00006*
	GY●T	3.34	0.472E-5*
H_4 Surgical Cost Justified for...	Moderately Compromised Function (B3B)	34.11	0.143E-7*
	Treatment Option (T)	362.18	0.0*
	B3B●T	16.44	0.630E-11*
	Mildly Compromised Function (B3C)	3.50	0.06259
	Treatment Option (T)	170.16	0.00004*
	B3C●T	5.20	0.00018*
	Moderately Compromised Esthetics (B3E)	25.71	0.721E-6*
	Treatment Option (T)	369.40	0.0*
	B3E●T	11.49	0.320E-9*
H_5 Willing to... for Anxious Surgical Patient	Switch to Camouflage (F3B)	15.72	0.00009*
	Treatment Option (T)	327.69	0.0*
	F3B●T	6.40	0.00002*
	Convince re: Surgery (F3O)	5.30	0.02203
	Treatment Option (T)	352.66	0.0*
	F3O●T	7.34	0.205E-5*
H_7	Total Psych Referral (G)	2.83	0.06098
	T	238.42	0.109E-6*
	G●T	4.80	0.00094*

Note. H = hypothesis; GY = graduation year, grouped I2 data; T = treatment option; *$P < .001$; ● = interaction; B3_ = perception of justification for cost of surgery in case of B, moderately compromised function, C, mildly compromised function, E, moderately compromised esthetics; F3_ = for anxious pre-surgical patient, B, willingness to switch to camouflage or O, trying to convince to proceed with surgery; G = total psychological referral, grouped data

Hypothesis 1 addressed the influence of orthodontist experience level over treatment recommendations. Significant correlation between year of birth and year of orthodontic graduation ($r = .8905$, $P < .0001$) warranted presentation of analyses for graduation year alone. Table VII above and

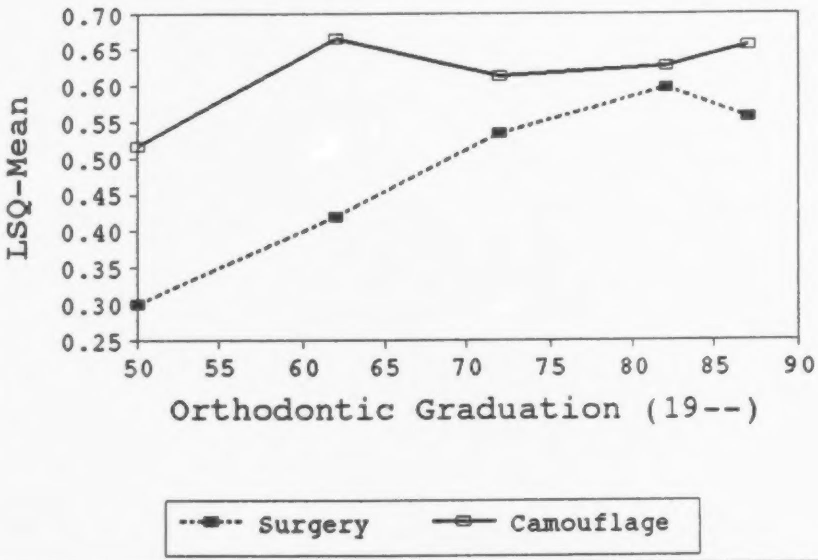
Appendices IX and X summarize ANOVA and LSQ-means for graduation year.

Trend analysis in the form of multi- and univariate tests of significance was done only for surgery and camouflage options for three reasons. First, LSQ-means within treatment category for the interaction between graduation year and treatment recommendation differed by no more than 0.100 except for the surgery, camouflage and "refer to another dental specialist" options. Second, the first and third of these options were considered related. Last, visual review of LSQ-means revealed a potential linear trend.

Graduation groups demonstrated a fairly common order of treatment recommendation preferences based on LSQ-means for the two-way interaction presented in Figure 4 and Appendix X. Ranked from most to least recommended, the treatment options were camouflage, surgery, refer to another dental specialist, no treatment, delay decision, refer for second orthodontic opinion and psychological referral. The most experienced groups differed by two reversals in this ranking: graduates from 1950 through 1961 ranked delayed decision third and referral to another dental specialist fifth; graduates from 1962 through 1971 ranked no treatment third and referral to another dental specialist fourth.

Figure 4 illustrates interaction between graduation year and surgical or camouflage recommendation. Pillai's multivariate tests for linear, quadratic and cubic trends were significant [F(2, 310) = 17.74, 4.07, and 3.75, P < .000, .018, and .025 for linear, quadratic, and cubic trends, respectively]. The univariate tests revealed significant linear and quadratic trends only for the surgical option [F(1, 311) = 34.64 and 8.15, P < .000 and .005 for linear and quadratic trends, respectively] and a significant cubic trend only for the camouflage option [F(1, 311) = 4.30, P < .039].

Figure 4.
Recommendation by Cohort



Hypothesis 2 pertained to the influence of oral surgeon availability over orthodontists' treatment recommendations. Nonsignificant ANOVA were obtained for the objective population measures of oral surgeon availability. Similarly nonsignificant results were obtained for the subjective measures of oral surgeon availability: availability judgement (G1P), delay to initial surgical consultation (G3P) and time between final surgical consultation and actual surgery (G5P). Results are given in Appendix XI.

As reported in Appendix XII for Hypothesis 3, no significant interaction occurred between treatment recommendation and respondents' perception of the financial cost of surgery as a burden to either the patient or the provincial health care system.

Response frequencies for the item (B3) intended to test Hypothesis 4 -- influence over treatment recommendation by perception of justification for cost of surgery based on severity of functional or esthetic defect -- are graphed in Figure 5. Note that only 1.6% of respondents felt surgery to be unjustified. ANOVA summaries for moderate functional or esthetic defects and for mild functional defects are presented in Appendix IX. Nonsignificant results or those not pertinent to the hypothesis are presented in Appendix XIII.

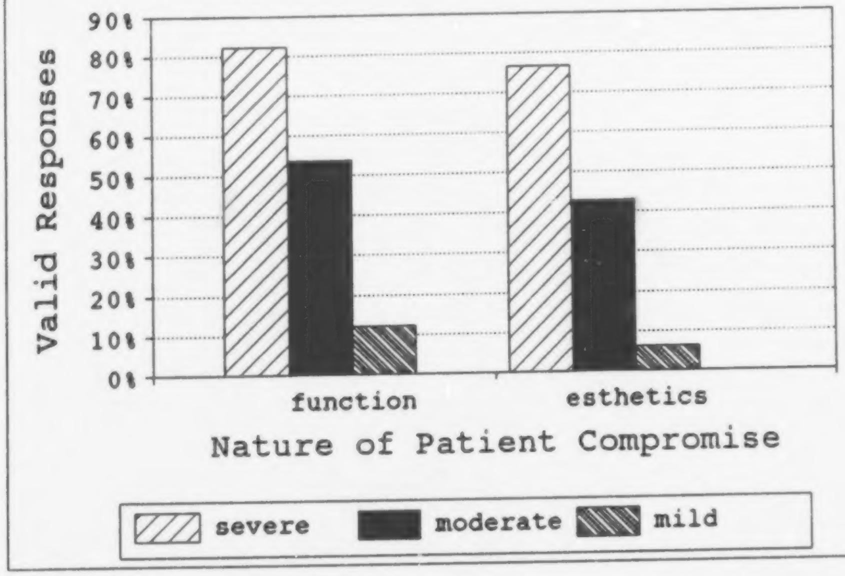


Figure 5.
Justification for Surgery

For Hypothesis 4, the multiple comparisons presented in Tables VIII to X were performed in preference to trend analysis (despite the possible trend illustrated in Figure 6) due to significance of the pertinent two-way interaction and lack of significance of the main effect mild functional defect. In Figure 6, respondents willing to recommend treatment for a patient with mild esthetic or functional compromise also demonstrated increased overall frequency of surgical referral.

Table VIII. ANOVA, LSQ-MEAN: Treatment Option by Perception of Justification for Cost of Surgery in Case of Moderately Compromised Function (B3B)

Treatment Option	B3B		
	Not Chosen	Chosen	Difference
surgery	**0.391**	**0.600**	**0.209***
camouflage	0.589	0.655	0.066
no treatment	0.199	0.269	0.070
delay decision	0.174	0.185	0.011
consult other DDS	**0.184**	**0.338**	**0.154***
second opinion	0.132	0.096	0.036
consult psychologist	0.061	0.066	0.005

Note. Multiple comparisons: $\alpha = 0.05$; required difference = 0.11; *SE* = 0.02; *df* = 1884; Scheffé = 4.74; * = observed difference exceeded required difference.

Table IX. ANOVA, LSQ-MEAN: Treatment Option by Perception of Justification for Cost of Surgery in Case of Mildly Compromised Function (B3C)

Treatment Option	B3C		
	Not Chosen	Chosen	Difference
surgery	**0.481**	**0.666**	**0.185***
camouflage	0.629	0.595	0.034
no treatment	0.235	0.248	0.013
delay decision	0.181	0.174	0.007
consult other DDS	0.257	0.342	0.085
second opinion	0.112	0.117	0.005
consult psychologist	0.064	0.060	0.004

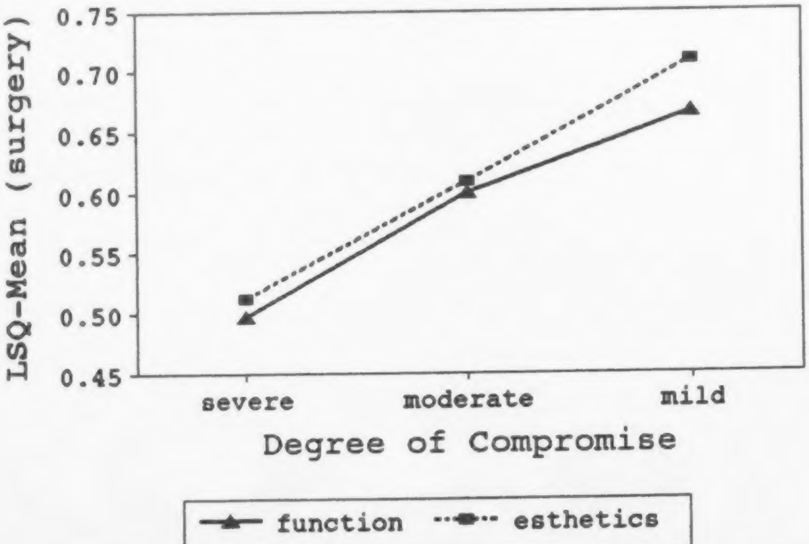
Note. Multiple comparisons: $\alpha = 0.05$; required difference = 0.17; *SE* = 0.04; *df* = 1813; Scheffé = 4.74; * observed difference exceeded required difference.

Table X. ANOVA, LSQ-MEAN: Treatment Option by Perception of Justification for Cost of Surgery in Case of Moderately Compromised Esthetics (B3E)

Treatment Option	B3E		
	Not Chosen	Chosen	Difference
surgery	**0.425**	**0.609**	**0.184***
camouflage	0.605	0.650	0.045
no treatment	0.208	0.276	0.068
delay decision	0.178	0.183	0.005
consult other DDS	**0.210**	**0.343**	**0.133***
second opinion	0.118	0.105	0.013
consult psychologist	0.062	0.065	0.003

Note. Multiple comparisons: $\alpha = 0.05$; required difference = 0.11; $SE = 0.02$; $df = 1885$; Scheffé = 4.74; * observed difference exceeded required difference.

Figure 6.
Recommendation by Justification



There were many significant correlations between responses to Hypothesis 4 variables. Only defects of similar severity demonstrated correlations greater than .240. Correlations between responses to justification for treatment on the basis of functional versus esthetic defect were r = .4596, .6344 and .6428 for the severe, moderate and mild defects respectively, all with $P < .001$, $n = 312$.

Under Hypothesis 5, Appendix IX gives ANOVA for mid-treatment change of plan for the apprehensive orthognathic patient. Appendix XIV contains a significant 3-way ANOVA interaction which is not pertinent to the hypothesis, plus nonsignificant results. LSQ-means and multiple comparisons for significant interactions are contained in Tables XI and XII below.

Table XI. ANOVA, LSQ-MEAN: Treatment Option by Willingness to Switch to Camouflage for Anxious Surgical Patient (F3B)

Treatment Option	F3B		
	Not Chosen	Chosen	Difference
surgery	**0.459**	**0.537**	**0.078***
camouflage	**0.539**	**0.679**	**0.140***
no treatment	**0.193**	**0.267**	**0.074***
delay decision	0.166	0.193	0.027
consult other DDS	**0.240**	**0.293**	**0.053***
second opinion	0.132	0.100	0.032
consult psychologist	0.063	0.065	0.002

Note. Multiple comparisons: $\alpha = 0.05$; required difference = 0.05; *SE* = 0.02; *df* = 1885; Scheffé = 1.96; * observed difference exceeded required difference.

Table XII. ANOVA, LSQ-MEAN: Treatment Option by Convincing Anxious Surgical Patient to Follow Through with Surgery (F3O)

Treatment Option	F3O		
	Not Chosen	Chosen	Difference
surgery	**0.447**	**0.578**	**0.131***
camouflage	0.606	0.638	0.032
no treatment	0.242	0.229	0.013
delay decision	0.188	0.174	0.014
***consult other DDS**	**0.231**	**0.322**	**0.091***
second opinion	0.119	0.106	0.013
consult psychologist	0.070	0.057	0.013

Note. Multiple comparisons: $\alpha = 0.05$; required difference = 0.06; *SE* = 0.02; *df* = 1885; Scheffé = 4.74; * observed difference exceeded required difference.

Under Hypothesis 6, pertaining to influence of orthodontist facial self-perception over treatment recommendations, none of the ANOVA demonstrated significant interactions as shown in Appendix XV, and main effects were not of concern.

Please refer to Table XIII for vignette abbreviations referenced under Hypotheses 7 to 27.

Table XIII. Vignette Abbreviations

Item	Description	Item	Description
(D) 1	developmental (defect)	(D) 13	uncooperative
(D) 2	traumatic (defect)	(D) 14	time/ cost
(D) 3	TMJ	(D) 15	fears GA
(D) 4	(excellent) esthetics	(D) 16	(self-)esteem
(D) 5	(negative) life	(D) 17	indecisive
(D) 6	not listen	E1	no support
(D) 7	(poor) health	E2	resemblance
(D) 8	TMJ/esthetics	E3	minor, dispute
(D) 9	extrovert	E4	spousal pressure
(D) 10	(self-)image	F3	anxious
(D) 11	introvert	G4	impatient
(D) 12	intolerant		

Note. ( ) = optional in abbreviation.

Hypothesis 7 pertained to influence of anticipated level of patient psychological difficulty over treatment recommendation. Figure 7 shows that referral focused mainly on the hypothetical patient with negative life events, low self-esteem or a desire to defer surgery due to anxiety.

Similarly, cumulative psychological referral in Figure 8 shows most respondents to have recommended referral for only one or two of 20 same-format vignettes.

Figure 7.
Recommendation: Psychologist

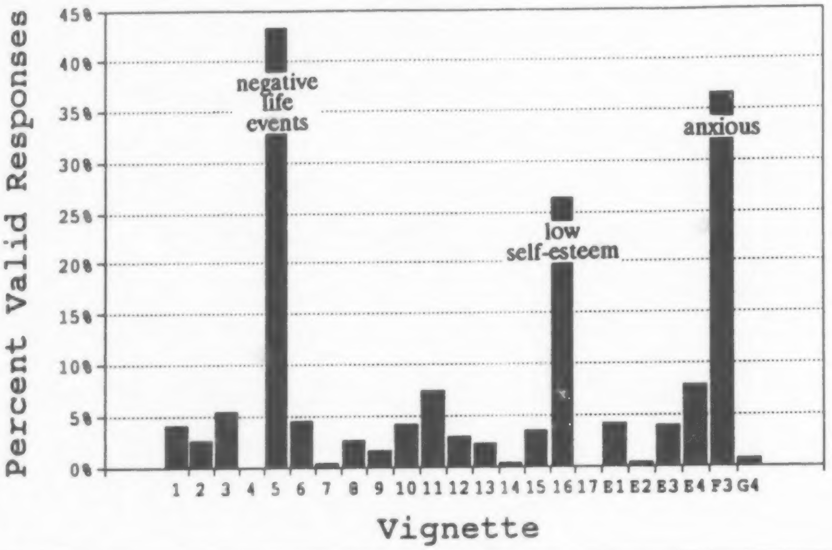
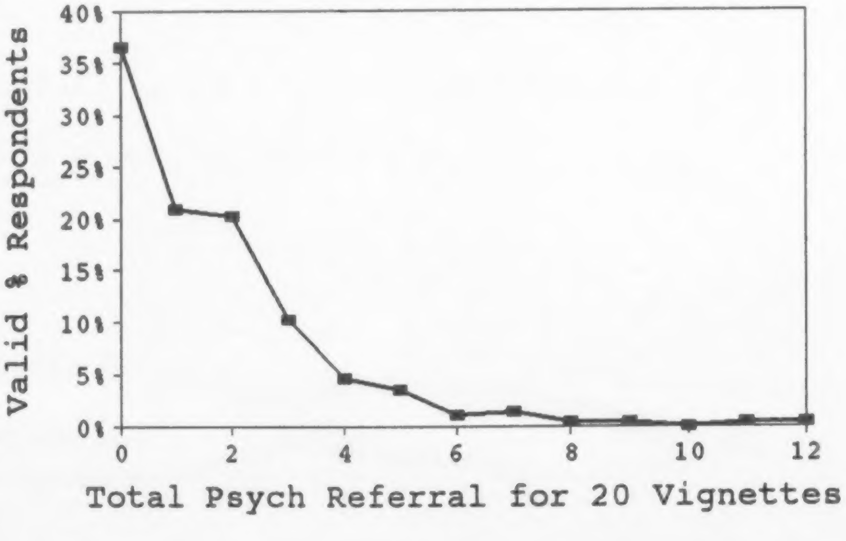
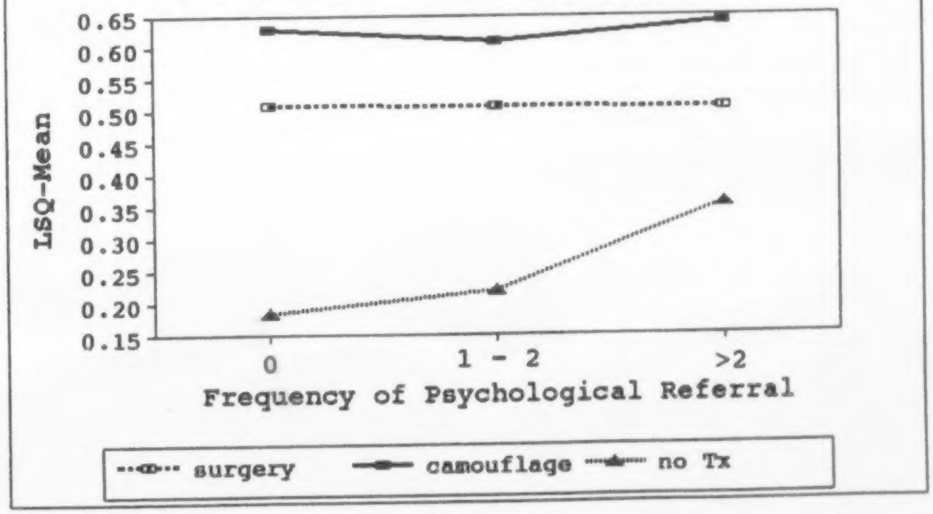


Figure 8.
Cumulative Psychological Referral



The ANOVA reported in Appendix IX was performed on grouped data out of necessity for reasonable sample size: no referral, one or two referrals, and more than two referrals. A nonsignificant two-way interaction between group and vignette along with a nonsignificant three-way interaction indicated that the three vignettes for which psychological referral predominated were not treated differently by the respondent groups. The significant two-way interaction between psychological referral group and major treatment recommendation illustrated in Figure 9 was subjected to multiple comparisons, confirming that only the difference between the 'no' and 'more-than-two' referral groups for recommendation of no treatment was significant [Scheffé $F(1,722) = 3.95$, $P < .05$, $SE = 0.04$].

Figure 9.
Recommendation by Psych Referral



Tests of Hypotheses: Patient Traits

Hypothesis 8 pertained to influence of patient age over orthodontists' treatment recommendations. Please refer to Figures 10 to 12 for graphs of frequencies with which respondents indicated age limitations they perceived to growth modification and earliest and latest feasible surgeries.

Students' upper-tail *t*-tests were applied to the mean frequencies to determine significance of differences in age between treatment categories. Latest growth modification occurred significantly earlier than earliest feasible surgery (female 13.5 versus 14.9 years, $t = 9.1$; male 15.0 versus 16.3 years, $t = 7.3$; *df* approx 311, $P < .0005$). Latest feasible surgery, at 55.1 and 55.4 years in females and males respectively, occurred significantly later than earliest surgery ($t > 45$, *df* approx 120, $P < .0005$). With respect to treatment limitations, 3.2% of respondents felt that growth modification could be done after age 18 in either a male or a female patient ($n = 313$). Significantly fewer, 32.1% versus 67.9%, felt surgery to be an option before age 8 than not, especially for congenital malformations ($t = 6.3$, *df* approx 200, $P < .0005$). No significant difference existed between those who felt there to be an upper age limit to orthognathic surgery and those who felt there to be no such limit ($t = 1.8$, *df* approx 200).

Figure 10.
Growth Modification Limit

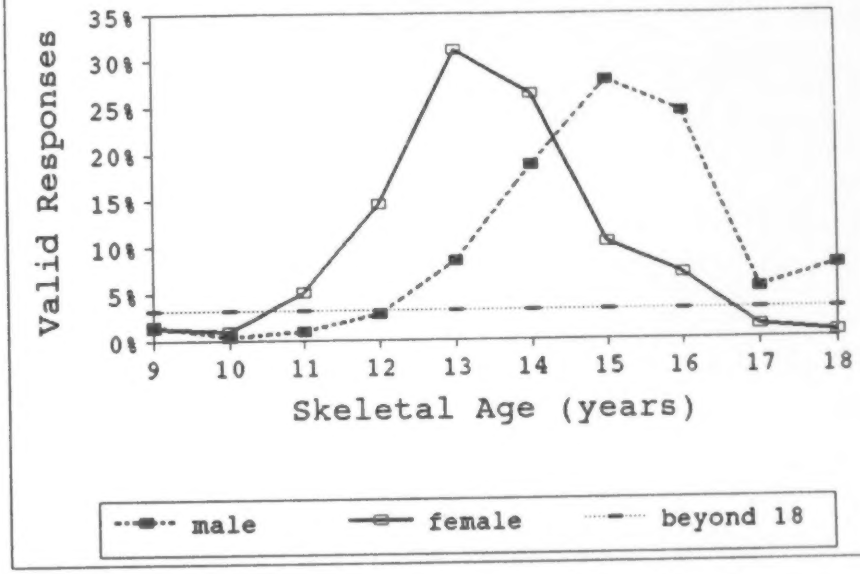


Figure 11.
Earliest Recommended Surgery

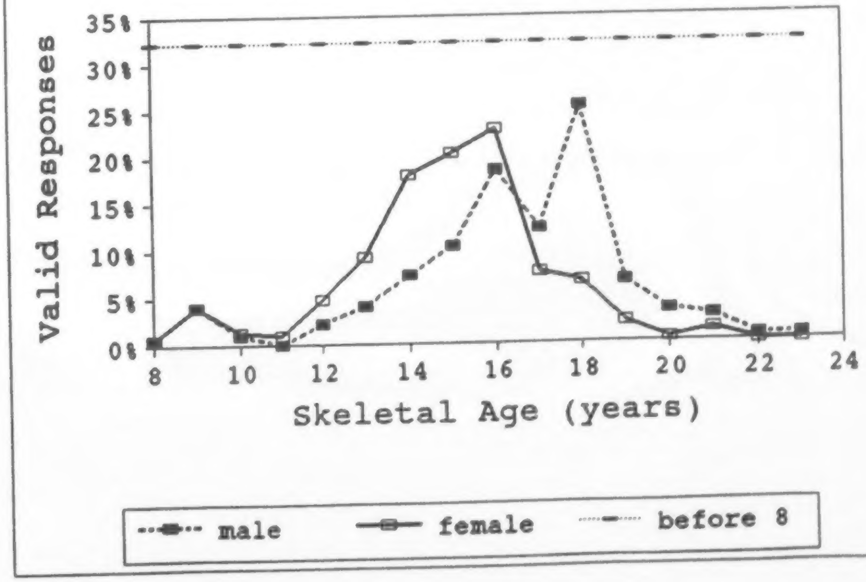
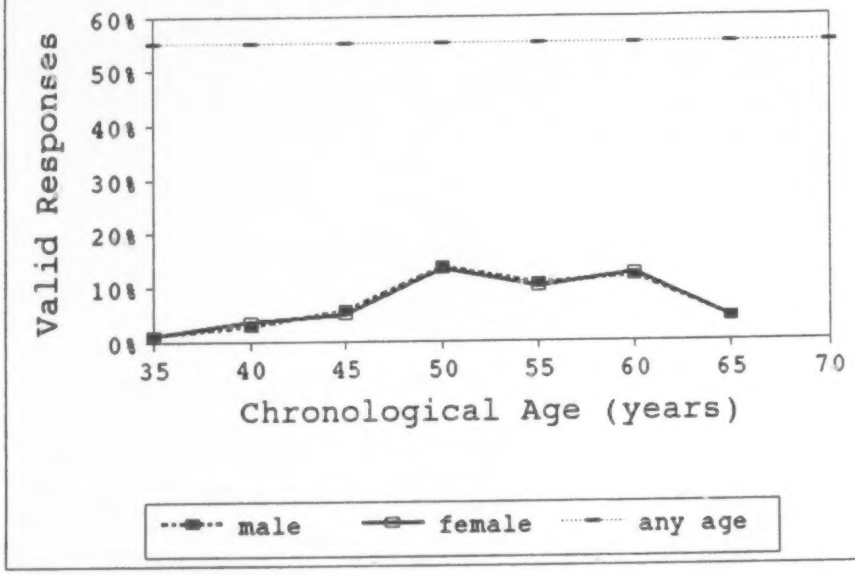


Figure 12.
Latest Recommended Surgery



For Hypotheses 9 to 27 the degree of respondent influence over a patient was determined subjectively with the 'influence factor' illustrated in Figure 13 or objectively with multiple comparisons or *t*-tests to distinguish significant differences between surgical and camouflage recommendations. Most multiple comparisons are given in Table XIV while *t*-tests are discussed in text. Note that when respondents were asked to suppose that they were a borderline orthognathic surgery patient, 21.5% of them chose to be treated surgically, 74.4% chose camouflage and 8.7% did not want treatment (*n* = 309). Valid percent frequencies for selection of major treatment options for vignettes included under Hypotheses II and III are given in Figure 14.

Figure 13.
Influence Factor

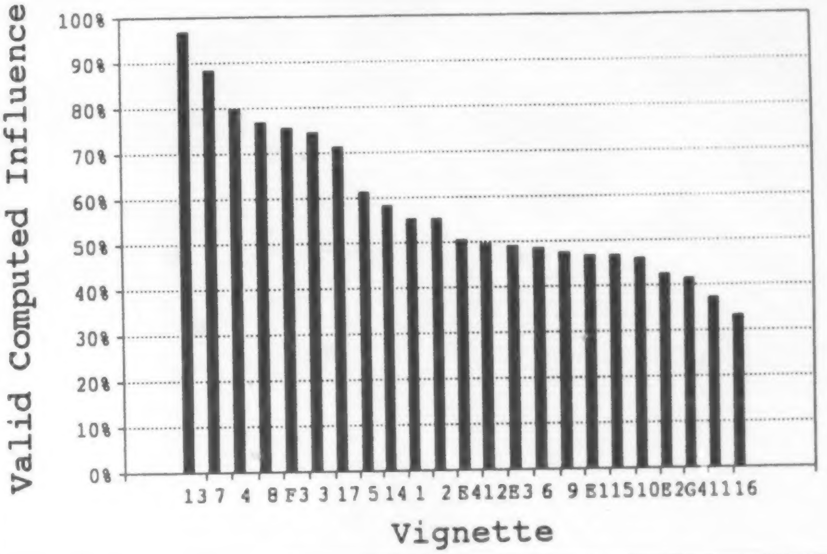


Figure 14.
H II,III: physical/psychological traits

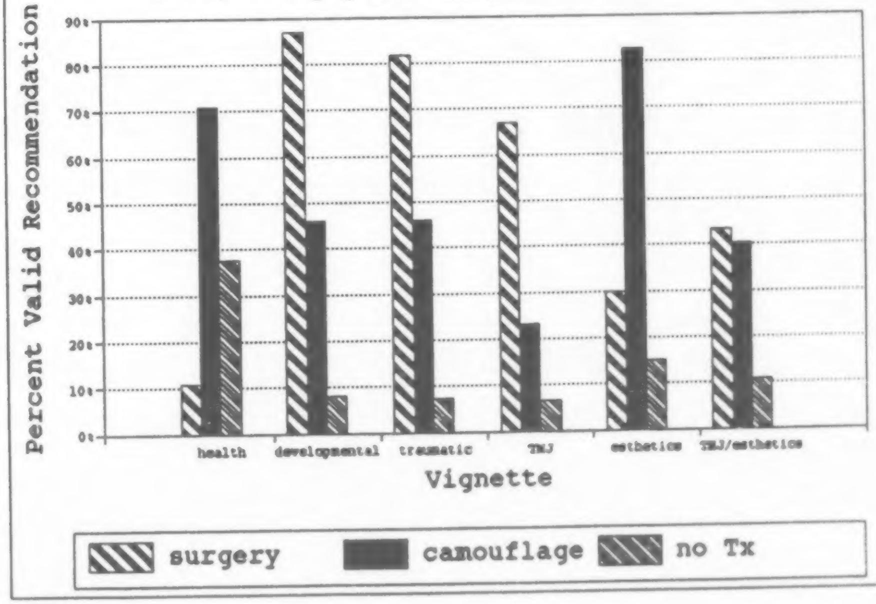


Table XIV. Observed Difference Between LSQ-Means for Major Treatment Recommendations, Hypotheses II - VI

H_o	Item	A-B	B-C	A-C
9	D7	0.60*	0.33*	0.27*
13	D13	0.04	0.49*	0.52*
14	D12	0.11*	0.05	0.06
15	D14	0.30*	0.28*	0.01
16	G4	0.06	0.44*	0.50*
17	D6	0.13*	0.36*	0.23*

Note. *df* = 5801.

H_o	Item	A-B	B-C	A-C
18	D15	0.35*	0.64*	0.29*
20	D10	0.17*	0.48*	0.65*
21	D16	0.04	0.56*	0.52*
24	D5	0.07	0.33*	0.40*
23/26	E1	0.18*	0.27*	0.09*
27	E2	0.30*	0.68*	0.38*
23/26	E3	0.15*	0.27*	0.12*
23/26	E4	0.06	0.33*	0.27*

Note. *df* = 4175.

Note. H_o = hypothesis; A = surgery; B = camouflage; C = no treatment. Multiple comparisons: $\alpha = 0.05$; required difference = 0.08; *SE* = 0.03; Scheffé = 2.45; * observed difference exceeded required difference.

Hypotheses 10 and 11, pertaining to the influence of patient TMJ health and existing facial esthetics over treatment recommendations, were addressed in an overlapping fashion with vignettes D3, D4 and D8. Because vignettes D3 and D8 were of a different format than the majority of the vignettes and not included in the ANOVA model, multiple comparisons were not convenient and upper-tail *t*-tests for comparison of differences between surgical and camouflage recommendations were done instead. Surgery was significantly favoured for the TMJ patient [*t*(*df* approx 200) = 7.4,

$P < .0005$], camouflage was significantly favoured for the patient with existing excellent facial esthetics [t(df approx 200) = 10.0, $P < .0005$]. Neither were favoured for the TMJ patient with good esthetics [t(df approx 200) = 0.47, $P < .0005$).

Hypothesis 12 pertained to the influence of developmental versus traumatic defect over treatment recommendation. Comparisons between questionnaire items D1 and D2 were done for every treatment option, with no significant difference between the two vignettes [Scheffé F (df 11748) = 1.96, $p < 0.05$, $SE = 0.03$, required difference = 0.06). Observed differences were as follows: surgery, 0.05; camouflage, 0.15E-2; no treatment, 0.61E-2; delay treatment, 0.33E-2; refer to dental specialist, 0.05; refer for second orthodontic opinion, 0.29E-2; refer to psychologist, 0.02.

A similar set of comparisons were done for Hypothesis 25 pertaining to the influence of patient intro- versus extroversion over treatment recommendation (using items D9 and D11). (Frequencies of recommendation of major treatment options for psychological traits, Hypotheses V, are presented in Figure 15 below.) Some significant differences were found [Scheffé F (df 11748) = 1.96, $P < 0.05$, $SE = 0.03$, required difference = 0.06]. Observed significant differences included: surgery, 0.10; refer to dental specialist, 0.06; refer to psychologist, 0.06. Observed nonsignificant differences included: camouflage, 0.03; no treatment, 0.03; delay treatment, 0.02; refer for second orthodontic opinion, 0.62E-2.

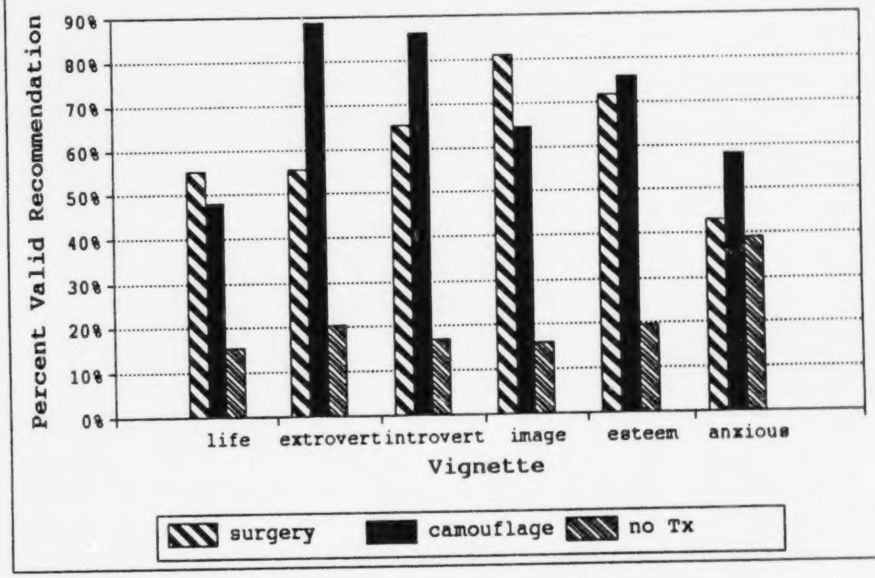


Figure 15.
H V: psyche

For Hypothesis 22, percent response consistent versus inconsistent with literature on coping mechanism were subjected to an upper-tail *t*-test. For item F1, 74.4% versus 23.4% of responses were inconsistent versus consistent with knowledge of vigilant coping. For item F2, 68.3% versus 23.6% of responses were inconsistent versus consistent with knowledge of avoidant coping. An upper-tail test revealed significant inconsistency with respect to either coping mechanism (vigilant *t* = 8.9, avoidant *t* = 7.6, both *df* approx 200, *P* < .0005).

Hypotheses 23 and 26, pertaining to the influence of external patient motivation and support system characteristics over respondents' recommendations, were examined using multiple comparisons within vignettes E1, E3, and E4. Refer to Figure 16 for frequencies of recommendation of major treatment options for support system traits (Hypotheses VI).

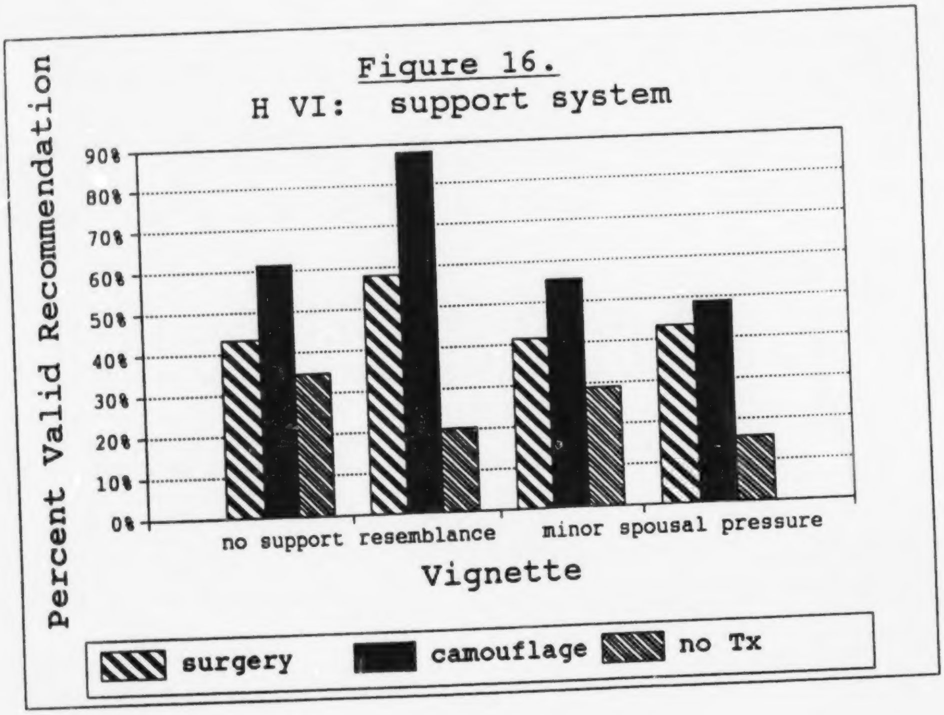


Figure 16.
H VI: support system

In the case of family pressure not to undergo treatment, "no treatment" was recommended contrary to family pressure at a significantly lower frequency than surgery or camouflage. For the minor who wanted surgery but whose parents disagreed, camouflage was recommended in keeping with parental pressure at a significantly higher rate than either surgery or no treatment. For the patient with misgivings about surgery but whose spouse favoured surgery, no significant difference between camouflage and surgical recommendations occurred.

For Hypothesis 19, unique vignette D17 pertaining to the indecisive patient was t-tested (upper-tail) since it had not been included in the ANOVA model. Refer to Figure 17 for frequencies of recommendation of major treatment options for patient attitude (Hypotheses IV). Of respondents, 24.9% recommended surgery to the indecisive patient and 31.1% recommended camouflage. The difference between the two was not significant [t (df approx 200) = 0.91, $P < .0005$]. The most highly recommended option for this patient (72.2% of respondents) was to complete the consultative process prior to making a decision. Note that 12 respondents commented on the "P" versus "Q" substitution typographical error in this vignette.

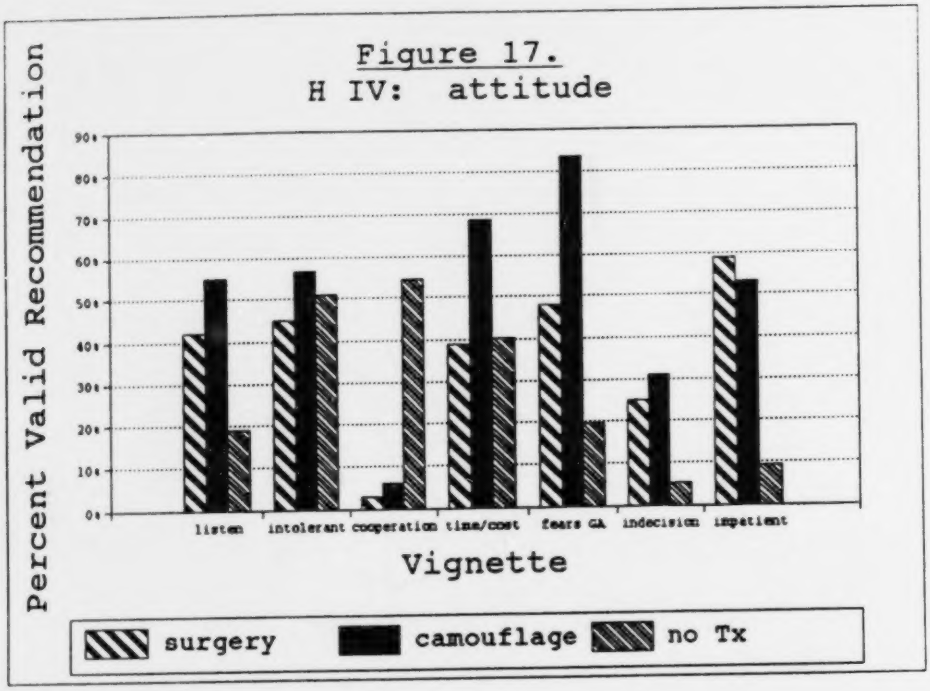


Figure 17.
H IV: attitude

Tests of Hypotheses: Oral Surgeon Traits

Hypothesis 28, related to the influence of orthodontists' perception of oral surgeon competence over treatment recommendation, was not tested beyond observation of valid cumulative per cent since 92.9% of respondents felt that their oral surgeon had good to excellent technical expertise. Only 0.3% felt that their oral surgeon was poor.

Similarly, Hypothesis 29 was not tested beyond observation of valid cumulative percent. Oral surgeons were described as receptive or very receptive to discussing cases by 97.4% of respondents while only 1.6% of respondents described the oral surgeon as unreceptive or very unreceptive.

Under Hypothesis 30, regarding the comprehensiveness of the oral surgeons' discussion with the potential orthognathic patient, 77.1% of respondents felt that oral surgeons advised patients in detail of the risks of surgery, 20.3% felt that risks were discussed to a moderate degree while only 1.3% felt that the degree of detail was minimal or non-existent. The last category was selected significantly less frequently than the first two, but had insufficient sample size to warrant further analysis. An upper-tail t-test confirmed a significant difference between frequency for the first two categories [t(df approx 200) = 9.8, $P < .0005$]. Thus, ANOVA was applied to "in detail" and "to a moderate degree". The results were nonsignificant and are presented in Appendix XVI.

Tests of Hypotheses: Psychologist Traits

Hypothesis 31, regarding the influence of psychologist availability over frequency of psychological referral, was not tested intensively for three reasons. First, 49% of respondents admitted to not knowing psychologist availability. Second, 80.4% of respondents reported not knowing how promptly an appointment could be booked with a psychologist in their practice area. Third, overall referral to psychologists was low (reported routine psychological referral of 1.6% and similarly low recommendation for psychological referral for all but three vignettes). Of the

51% of respondents who felt they knew psychologists' availability, the majority (20.9%) felt that it was poor.

Hypothesis 32 was intended to investigate the influence of perceived psychologist expertise over treatment recommendation, particularly in cases in which the vignette subject was more likely to be referred for psychological consultation. A large number (81.6%) of respondents did not know the expertise of local psychologists, therefore the issue was pursued no further statistically.

Hypothesis 33 was intended to investigate the influence of psychologist receptivity to discussing patient needs over orthodontists' treatment recommendations. Of respondents, 82.1% reported that the issue did not apply to them, presumably since respondents did not routinely refer patients to psychologists. Thus, Hypothesis 33 was not judged worthy of further statistical analysis.

Respondent Comments

All vignettes were coded for comments "patient's decision", "respondent favours surgery" and "respondent favours camouflage". Although comments could not be analyzed with any validity, it was interesting to note that many respondents wanted the patient to make the decision regarding treatment option despite the fact that the respondent might have chosen only one of the major treatment options. Only two vignettes (traumatic and developmental defect) demonstrated comment samples approaching 10% of the respondent sample size. The comments summary in Appendix XVII, part 1 includes only the three categories of comment just mentioned. Other comments judged to be interesting or representative (*) of respondents are given in Appendix XVII, part 2, categorized as to questionnaire item.

IV. DISCUSSION

Data Entry

The error level was well within the range of acceptability,[47] justifying verification of only 20% of responses. Error was related to interpretation of comments, which could not be subjected to strict analysis anyway. Ideally, all data entry conventions should have been defined prior to entry. However, situations arose part-way through data entry and conventions had to be defined in progress. Given the low error rate, the large number of data points for entry, and the few conventions which had to be introduced in progress, it was not feasible to re-enter data after finalization of conventions. (280 questionnaire variables by 334 respondents plus 17 demographic variables by 288 locations equalled 98,416 data points, excluding data entry for respondents' comments and for some computed variables.)

Respondent Profile and Non-Response Bias

It was impossible with certainty to differentiate between respondents and non-respondents. Reasons given by partial- or non-respondents for non-response may have been unique to those who returned the questionnaire. Non-response fraction due to disruption of postal service was unknown.

Limitations of occupation items became apparent upon data analysis. The distinction between part- versus full-time practice was not clear, as revealed by respondents' comments regarding the number of days per week which they considered full-time. Academic and institutional descriptions may not have been distinct since the academic is employed at an institution. Even if academic and institutional categories had been distinct, respondents inclined toward such appointments would not necessarily have had such an opportunity in a smaller centre. The proportion of the sample frame employed as academics was not verified for the purpose of assessing non-response bias since detailed further analysis of this item was not indicated. Level of post-graduate education seemed best suited of the respondent characteristics to inclusion with Hypothesis 1. However, no means was readily available for verifying level of education to assess non-response bias, whereas verification of graduation year was possible to a degree.

Since there were no significant differences between graduation cohort and sample frame with respect to response rate, it was not necessary to speculate on reasons for cohort non-response.

Response by province was presented for general interest. Differences between treatment recommendations by orthodontists from different provinces were not tested, the rationale being that due to the small number of positions in Canadian graduate orthodontic programs, many of the respondents would have trained in American or other programs. Since respondents were not asked to supply the name of their graduate school, philosophical differences due to education could not be tested. Such a test would require a fairly large sample in order to have a valid sample size per institution. Good response rates came from the western provinces and three of the Maritime provinces. Western response could have been motivated by the study originating in a neighbouring area. Good Maritime response may have been partly an artefact due to the small number of orthodontists in this region, but also could have been related to the small region wanting to ensure a voice in a study described to them as intended to be representative of Canada. Three of the four provinces whose response was less than that for the total sample were provinces which have graduate orthodontic programs. The two most populous provinces were also among this group, and their response rates differed by less than 10% from the total for the entire sample, perhaps indicating no individual trend toward non-response.

Reliability and Validity

Because the questionnaire was designed to be broad in its scope, very few of the items tested similar issues. Thus, reliability testing was limited. Reliability coefficients were low for sections A and B but moderate to good for vignette sections E and D respectively, despite testing of different issues in the vignettes. Similarities between items may be attributed to baseline attitudes toward the seven treatment options. Differences in treatment of the vignette patients became more apparent upon comparison of some of the valid percentages of choice of option as well as the ANOVA interactive analyses.

Correlation between sections B and C with respect to degree of yea- or nay-saying seemed coincidental. Responses to scale items in section B tended to the extremes whereas responses to section C were less skewed. Actual acquiescence was unlikely since correlation was low, topics addressed in sections B and C were different, scale items in section B were interspersed throughout the section, and similar correlation was not observed between sections G and H. Low and nonsignificant correlations indicated reliability of the questionnaire in that sections addressed different topics, as intended.

Further statistical testing could be done to analyze the quality of the questionnaire as a research instrument. An example would be application of generalizability theory to vignettes and treatment options both treated as random variables. Such a test might be appropriate if a similar instrument were to be used at a future date. However, this instrument claims only to be a broad measure designed to gain insight into an aspect of orthodontic decision theory apparently as yet unstudied in the English language literature.

Major Hypotheses I: Orthodontist traits

Three attitudes toward risk have been defined: risk-neutral, risk-averse and risk-preferring.[2] According to Watson and Buede, aversion is the most common attitude toward risk.[4] Respondents in the present study demonstrated aversion to health risks by virtue of recommending camouflage more highly than surgery. Camouflage was highly recommended whether respondents were selecting treatment for themselves (74.4% chose camouflage) or for a hypothetical patient (camouflage predominated in 12 of 23 vignettes, surgery in 4 and neither in 7).

Two explanations might exist for respondents' apparent risk aversion. First, respondents may simply prefer the least physically risky treatment option. Second, respondents may have been risk-averse due to confrontation with a majority of vignettes (16 of 23) describing patients with traits having negative implications for patient post-treatment satisfaction.

The correlation between year of birth and graduation year may not have equalled unity due to the mean 31 year separation between the two and variation in age at graduation.

Prominent ranking of "delay decision" or "no treatment" by graduates from 1950 through 1961 and graduates from 1962 through 1971 respectively may have indicated a more conservative approach by experienced groups or less strict association of oral surgery with "other dental specialist".

Null hypothesis 1, pertaining to the influence of orthodontist experience over treatment recommendations in borderline orthognathic surgery cases, was rejected on the basis of significant linear and quadratic trends associated with the interaction of surgical recommendation and recency of graduation and a significant cubic trend associated with the interaction of camouflage recommendation and recency of graduation. Rejection of Hypothesis 1 coincided with results of a breast cancer study in which treatment decisions varied with physician age according to data presented but not statistically scrutinized.[14]

The highly significant linear increase of surgical recommendation with recency of orthodontic graduation could have three explanations. First, acquisition of orthodontic education as surgical technology became increasingly advanced and accepted led to greater comfort with surgical recommendations. Second, decreased acceptance by experienced graduates of adverse surgical outcomes led to decreased frequency of surgical referral. Third, increased experience resulted in greater expertise with camouflage orthodontics or the decision not to treat certain borderline cases and thus fewer surgical recommendations.

Decreased surgical recommendation by the most recent graduates (the quadratic relationship) may have reflected an initially cautious approach to treatment, initial willingness to treat borderline cases using camouflage, or behaviour in accordance with theories discussed below related to polynomial-style ANOVA interactions.

Cubic relationship of camouflage recommendation with recency of orthodontic graduation may be consistent with the previously-discussed initial tendency of recent graduates not to recommend surgery, with the general tendency of least recent graduates to recognize "no treatment" as an option, or with polynomial-related theories discussed below.

The fit of recommendations to higher order polynomials (quadratic, cubic) illustrated fluctuation consistent with 'fads' in surgical versus camouflage treatment similar to the commonly-described pendulum of extraction versus non-extraction orthodontics. Superimposition of quadratic and cubic polynomials for surgery and camouflage, respectively, may be consistent with one graduation cohort favouring surgery and disfavouring camouflage with the opposite relationship for another cohort. Whether this was due to a cohort or a maturational effect could not be determined due to the questionnaire's cross-sectional design. Accurate predictions of future orthodontists' attitudes toward treatment recommendation could not be made based on the cross-sectional data. Further research would be indicated for those interested in addressing surgical demands by changing provincial health care coverage or availability of operating room time to oral surgeons.

Failure to reject Hypothesis 2, regarding influence of oral surgeon availability over orthodontists' treatment recommendations, was based on lack of significant interaction between objective or subjective availability estimates and treatment recommendations. The subjective availability estimates may be more highly associated with orthodontists' referral behaviour than the objective estimates. Failure to reject H2 leads to the reassuring assumption that patients living in areas of low oral surgeon availability would receive similar treatment recommendations to patients living in areas of higher oral surgeon availability. Failure to reject Hypothesis 2 was consistent with ethnographic subject 2's comment that "surgeon characteristics would only influence [the] decision whom to refer to, [it] might [have to] be some distance" (Appendix I). Future research could address the issue of whether patient attitude influences travel for consultation.

Limitations previously discussed to conclusions regarding Hypothesis 2 include limitations of available population data and the decision not to analyze responses pertaining to satellites. Approximately 100 respondents participated in satellite contingency items, many of whom may have had satellites in highly populated areas. In such a case even satellite responses may not have altered the conclusions. It is unlikely, given the elective and specialized nature of orthognathic surgery, that demand by the few patients who have such surgery would influence distribution of oral surgeons in remote areas to a great degree.

Hypothesis 3 pertained to the influence over orthodontists' treatment recommendations of perception of the cost of surgery as a burden to patient or health care system. Considering the low incidence of perception of cost of surgery as a burden to either patient or health care system, failure to reject null Hypothesis 3 was not surprising. No parallel can be drawn with the reference literature:[15] the perception of cost of surgery as a burden (infrequent) was not found to bias respondents' treatment decisions, contrary to a similar proposed bias for plastic surgery.

It was interesting that respondents perceived no burden of cost to the health care system, especially given the elective nature of the procedure. Perhaps the difficulty lies in defining the point at which a borderline patient will significantly benefit --functionally, esthetically, psychologically -- from orthognathic surgery.

Respondents' disinterest in surgical fees was evident in their moderate knowledge of which surgical procedures were covered by health care and their minimal knowledge of the degree to which procedures were covered, except when covered completely, in which case respondents were fairly accurate.

Deficits of knowledge of fees were consistent with findings of other authors.[16] Statistics related to accuracy of knowledge of surgical fees are themselves limited by their basis on one oral surgeon's report per province and ambiguity of definition of functional versus esthetic genioplasty.

Lack of influence of fees could be explained two ways. First, respondents may have felt that most patients would understand that fees for elective, specialized procedures can be substantial if not funded by provincial health care. Second, respondents may have felt that since surgical fees are not determined by orthodontists, explanation of surgical fees is entirely the surgeon's responsibility. This latter sentiment was expressed by pre-test subjects. Acceptance of Hypothesis 3, in the author's opinion, reflects well on the autonomy given the patient by the respondent.

Hypothesis 4 intended to determine the influence over orthodontists' treatment recommendations of perception of justification for cost of surgery for varying degrees of functional or esthetic deficit. Considering that perceived cost of surgery as tested under Hypothesis 3 did not influence overall treatment recommendations, Hypothesis 4 may have resulted more in a test of the influence of severity and nature of defect over treatment recommendation than of the influence of perception of cost justification over treatment recommendation. Thus, the discussion focuses on severity of functional or esthetic defect.

Similarity of respondent attitudes toward surgical treatment based on severity of defect was borne out by moderately high correlations between components of item B3 describing the defect as mild, moderate or severe. It would seem that severity of defect, not cost or nature of defect, was most meaningful to respondents.

Neither perception of cost justification for surgery for severely compromised function nor esthetics influenced respondents' approach to treatment, the most likely explanation being that the majority of respondents believed treatment to be justified in the severe case. Despite this, null Hypothesis 4 would have to be rejected based on other significant ANOVA interactions.

The significant *F*-ratio for interaction between treatment option and perception of justification for cost of surgery for moderately compromised function or esthetics indicated substantial separation between groups based on response to these items. Multiple comparisons verified that respondents who believed surgery to be justified for moderately compromised function or esthetics recommended significantly more surgery and the related "referral to other dental specialist" (surgeon) than respondents who did not believe in such justification. Thus, respondents' seemed to demonstrate a general attitude toward surgery which was reflected in their recommendations in particular situations. The illustration of this general attitude in Figure 6 was made with the realization that interactions between surgical recommendation and severe compromise or mild esthetic compromise were nonsignificant.

Hypothesis 5 was intended to test the influence of orthodontists' flexibility in changing the anxious patient's treatment option mid-treatment over options the orthodontist recommends initially to borderline orthognathic patients. When presented with an anxious patient who would prefer not to proceed with surgery, respondents chose fairly equally among the options to switch to camouflage, convince the patient to proceed with surgery, send the patient for psychological consultation or suspend treatment. Only ANOVA for the first two categories were significant, leading to rejection of null Hypothesis 5.

Where "switch to camouflage" was chosen, respondents were more inclined to recommend surgery, camouflage, no treatment or referral to another dental specialist, but especially camouflage. Where "convince to proceed with surgery" was chosen, respondents were more inclined to recommend surgery or the related "refer to another dental specialist". The tendency in the respondent willing to switch to camouflage to generally recommend camouflage and the tendency in the respondent willing to convince the patient to proceed with surgery to generally recommend surgery illustrates an individual treatment recommendation trend similar to that discussed under Hypothesis 4.

The low *F*-ratio for the significant three-way interaction for willingness to make psychological referral for the anxious patient mainly involved either the vignette patient who does not listen to discussion of surgical risks or who is concerned with treatment time and cost. These findings may be meaningless when one considers that no real patient is as unidimensional as the vignette patients. Generalizations and trend analyses may be more meaningful than specifics from three-way interactions in a study based on vignettes rather than real patients.

As a variation on self-consistency theory, Hypothesis 6 was intended to demonstrate any influence of respondents' facial self-image over their general treatment recommendations. No such influence existed whether respondents' own subjective assessment, a reported 'objective' assessment by a colleague or an 'objective' treatment recommendation by a colleague were subjected to ANOVA. This led to failure to reject null Hypothesis 6. Apparently, any psychological 'baggage' a respondent might have carried regarding their own facial appearance was not reflected in their treatment recommendations to patients. Perhaps the basis of this finding was a healthy self-concept for a majority of respondents, and thus no inconsistencies with respect to facial self-image: they perceived themselves as attractive to varying degrees; their colleagues' assessment showed only about 10% to have facial structure warranting orthognathic surgery; less than 2% of them had actually felt the need to undergo orthognathic surgery; and many already had received some form of orthodontic treatment, suggesting acceptable dental esthetics.

Null Hypothesis 7, regarding the influence of anticipated patient psychological difficulty over the treatment recommendation for that patient, was _rejected_. Rejection on the basis of frequent psychological referral corresponding to frequent recommendation for no treatment could have reflected realization by this respondent group that the psychologically well-balanced patient could tolerate either surgery or camouflage, but the psychologically unbalanced patient would be best untreated. The patient at risk for psychological morbidity was not perceived by the respondents as coping differently with surgery versus camouflage.

The test for Hypothesis 7 was not as specific to the vignettes as intended and became more a test of the influence of recognizing psychological referral as an option over overall treatment recommendations. Data groupings seemed likely to distinguish reasonably among the respondent sample. Given the low psychological referral, the "1 to 2 referrals" group may represent those respondents who made the relatively common psychological referral for "negative life events" and "low self-esteem".

Where data were grouped nomothetically, results were interpreted as descriptive of the respondent group and not necessarily of the individual respondent.[45] In particular, conclusions regarding experience and willingness to make psychological referral apply more to the respondent group than the individual orthodontist.

Because analyses focused on the two-way interaction of respondent characteristic with treatment recommendation, significant results suggest a multiplicative decision model, a type of 'cognitive algebra' with which information is integrated to arrive at a decision.[45] Since it was not the intention of this study to arrive at a mathematical description of orthodontists' decision-making, this issue was pursued no further. Due to the unidimensional nature of the vignettes, little information integration occurred (there were seldom two traits included in the same decision process). Despite potential to determine probabilities or utilities for orthognathic outcomes (the 'outcome' of the algebraic model), it might be difficult to determine which type of model variables (emphasis on plurality) fit best in producing a decision.

Hypotheses II: Patient physical traits

For hypotheses pertaining to patient traits, a number of standards for estimation of 'influence' could have been used: a 'normal' control vignette; comparison between recommendations within the vignette; frequencies of combinations of recommendations within vignettes (influence factor); and the treatment the respondent would recommend for themselves. The latter three methods were available given the present study design, and of these, comparison within vignettes seemed reliable, although more descriptive of the group rather than the respondent. Influence factor and self-recommendation were more descriptive of individual respondents, but also more subjective.

Conflicting objectives existed in this study: in order to determine whether the respondent was making the treatment decision for the patient, it had to be assumed that, theoretically, no influence would mean equal frequency of recommendation of surgery and camouflage; however, most of the vignettes portrayed patients with negative attributes for which the respondents might feel more strongly about one treatment option than the other. This conflict was taken into consideration in the following discussion.

Rejection of null Hypothesis 8, pertaining to the influence of patient age over orthodontists' treatment recommendation, was expected, and consistent with age-related influences over treatment decisions in breast cancer therapy.[14] Peaks to perceived skeletal age limit on growth modification coincided with attainment of skeletal maturity. Male and female plots were similarly structured with the exception of possible increased perception of feasibility of growth modification for males at age 18. The general curves likely reflected anteroposterior growth modification whereas departure of male data from female data at age 18 may have reflected greater respondent perception of latent growth or later patency of the median palatine suture in males. That less than 5% of respondents believed growth modification to be possible beyond age 18 reflected less flexibility in this treatment modality contrasted with percent valid response to the possibilities of very early and very late surgeries.

Plots of earliest skeletal age at which surgery would be recommended peaked significantly later than plots for skeletal age limit on growth modification. The lag either reflects time to ensure that the majority of growth is complete prior to starting pre-surgical orthodontics, or time to perform pre-surgical orthodontics. The low frequency of surgical recommendations for males at age 17, given higher recommendations for ages 16 and 18, may reflect a freak predilection to even numbers, since these options within the questionnaire were not positioned such that one was more convenient than another to select. (The curves could be statistically smoothened to test significance of fluctuations.) A high frequency of respondents felt surgery to be an option before age 8, probably because the option was reinforced with the concept of developmental defects.

Plots for male and female patients beyond age 30 were almost indistinguishable, reflecting completion of skeletal maturation by both sexes. There was a significant age range over which surgery was thought to be an option, especially since only about half of the sample put a limit on late surgery. This may reflect respondents' desire to have the older patient make the treatment decision or the fact that respondents had not experienced problems in their own practices with adverse esthetic results based on decreasing soft tissue elasticity with age.

Null Hypothesis 9, regarding influence of patient systemic health over orthodontists' treatment recommendations, was rejected on the basis of a significant tendency to recommend camouflage to the patient in poor health and an influence factor second only to that for the uncooperative patient. Such a result is not likely a strict violation of the patient's freedom with respect to decision-making. Many (*n* = 49) of the respondents commented that the decision as to whether a patient was medically fit to undergo orthognathic surgery would be made by the physician, oral surgeon or both.

Hypotheses III: Patient physical traits with psychological overtones

Discomfort in the relationship between practitioner and patient, even with an undefined source, indicates a need for caution in the decision to proceed with treatment.[65] These vague biases (intuitive reactions) could be represented in the present study by vignette patients for whom "no treatment" or "psychological referral" were more highly recommended: the uncooperative patient, the patient trying to resolve negative life events with a positive facial change, the patient with low self-esteem.

Null Hypothesis 10, regarding the influence of patient TMJ health over orthodontists' treatment recommendations, was rejected. Note that splint therapy was at least as highly recommended as surgery, and many respondents commented that they would prefer to reevaluate the patient prior to proceeding with major treatment options. Considering major treatment options, the TMJ patient was treated predominantly surgically by respondents. Caution is indicated in interpretation of conclusions pertaining to items D3 and D8 since the skeletal discrepancy was described as having been diagnosed as contributing to the TMJ dysfunction. Some respondents took exception to this ($n \leq 10$), commenting that according to recent research, skeletal discrepancy is unrelated to TMJ dysfunction and that further, orthognathic surgery will not remedy TMJ dysfunction. Respondents who did not take exception to the concept of skeletal discrepancy as etiologic to TMJ dysfunction may not have been familiar with or agreed with the recent research. They may have accepted the diagnosis at face value and simply responded with the treatment option most likely to address the skeletal discrepancy.

Null Hypothesis 11, regarding the influence of patient excellent existing facial esthetics over orthodontists' treatment recommendations, was also rejected. The patient who wanted to maintain excellent existing facial esthetics was treated predominantly with camouflage. Perhaps the rationale was that orthodontics could be stopped and a compromise occlusion accepted if treatment started to adversely affect facial esthetics, whereas the facial change with surgery, even if mild, would be all-or-none.

The tendencies to recommend surgical treatment for the TMJ patient and camouflage treatment for the patient concerned with esthetics balanced out for the patient with both problems. Superficially, one might interpret this balance in decision-making as a 'mental-averaging'[45] type of 'cognitive algebra' -- the method by which information is integrated to arrive at a decision. As previously mentioned, such a conclusion regarding a mathematical model would have little validity based on group data. However, one could analyze respondents' combined responses to the items of interest. Analysis of combined responses through the informal 'influence factor' contradicted the mental-averaging concept for vignette D8. The high influence factor suggested that the number of respondents influencing the patient toward surgery was comparable to the number of respondents influencing the patient toward camouflage. Thus, individual decision strategies were used for the combined TMJ/esthetics vignette versus an average of the decisions for the separate TMJ and esthetics vignettes.

Failure to reject null Hypothesis 12, regarding difference in treatment recommendations by orthodontists for patients with developmental versus traumatic defects, was based on an apparent lack of respondent perception that the patient with a traumatic defect was at greater psychological risk than the patient with a developmental defect. It was interesting to note that surgical recommendation was high for both vignettes. Perhaps the most physical solution for two physical problems seemed appropriate to respondents. Perhaps in order for respondents to distinguish between the two patients with respect to psychology, the patient's attitude toward the defect and not just the nature of the defect had to be apparent. Perhaps respondents were ignorant of or disagreed with literature describing the patient with a traumatic defect as a greater psychological risk.[32] The most probable reason for discrepancy between response and expected response based on the literature was that a minority of respondents' patients would have a history of traumatic defect, especially traumatic defect with orthodontic implications.

Hypotheses IV: Patient attitude

Null Hypothesis 13, regarding the influence of patient cooperation over orthodontists' treatment recommendations, was rejected based on significant predominance of the "no treatment" option and highest influence factor of 23 vignettes. Characteristics of decision-making by a single actor were demonstrated elsewhere in this study, but particularly in the situation of the uncooperative patient. Rejection of the null hypothesis conceptually signified that the orthodontist did not allow the patient to make the treatment decision. This could be considered to be in the patient's best interests since non-cooperation could impair treatment outcome.

The most interesting aspect of Hypothesis 13 was the fact that, based on influence factor, respondents felt more strongly about the uncooperative patient than any of the other hypothetical patients, including the patient in poor health. Perhaps this was because the general health of a patient is out of the orthodontist's control, whereas the orthodontist might feel responsible for a patient's cooperation. Perhaps the results of Hypothesis 13 also indicated the degree to which orthodontists feel poor cooperation can adversely affect treatment, particularly for a borderline patient who presents more of a treatment challenge. The tendency was to delay starting orthodontic treatment until improved cooperation had been demonstrated, and unless there was an improvement, not to provide treatment.

Null Hypothesis 14, regarding the influence of patient intolerance of treatment-related discomfort and inconvenience over orthodontists' treatment recommendation, was rejected. Camouflage recommendation predominated over surgical recommendation for the intolerant patient. However, the influence factor for this vignette ranked 12th of 23. Less than half of respondents favoured either surgery or camouflage. The predominance of camouflage seems reasonable for the intolerant patient for two reasons. First, discomfort and inconvenience may be greater for the surgical than the camouflage option and could be avoided by favouring the camouflage option. Second, this patient might have represented a potential management problem to respondents (in which case no treatment would have been a good option). Some concern existed for validity of the test for Hypothesis 14 since some respondents (*n* = 25) asked in their comments whether the vignette patient wanted or needed treatment. Their question was valid due to faulty wording of the vignette, but not judged as likely to significantly effect response pattern.

Null Hypothesis 15, regarding the influence of patient acceptance of treatment cost and time over orthodontists' treatment recommendation, was rejected on the basis of predominance of the camouflage option over the other two major treatment options for the patient unaccepting of treatment time and cost. Rejection on the basis of the multiple comparison was supported by the influence factor which was higher than for the modal category. Rejection of this hypothesis was reasonable only if the respondent came from a province where health care coverage for orthognathic procedures was low or where there was a predominance of patients who would have difficulty financing surgery. However, rejection on this basis contradicts results of Hypothesis 3, in which it was shown that cost of treatment does not influence treatment recommendation. Further research in this area might be necessary to clarify the issue.

Hypothesis 16 pertained to the influence of patient patience with respect to surgical delays over orthodontists' treatment recommendations. There was failure to reject the null hypothesis for the patient unwilling to tolerate delay to surgical consult. The "no treatment" option was significantly less frequently recommended than surgery or camouflage, but this was not regarded as undue influence since the orthodontist was obviously not going to force the patient to start treatment. Also, the vignette ranked 20th of 23 with respect to influence factor. The results of this hypothesis were interesting: the patient was not regarded as a management liability. Some respondents (*n* = 14) were even willing to hasten such a patient's treatment by referring them to an alternate oral surgeon. Perhaps the only time this would be unreasonable would be if the impatience was superimposed on an unhealthy motivation for surgery, an issue which could not be addressed in the present study.

Null Hypothesis 17, regarding the influence of patient seriousness of consideration of surgical risks over orthodontists' treatment recommendations, was rejected on the basis of significantly higher camouflage than surgical recommendation for the patient who is not serious. However, results for this hypothesis were inconclusive from the point of view that the vignette ranked 15th among 23 vignettes with respect to influence factor. Rejection of the hypothesis was justified since the multiple comparison was a more formal, reliable test. However, future research might be required to determine whether orthodontists' influence over the inattentive patient is 'clinically' significant.

Null Hypothesis 18, regarding the influence of patient fear of general anaesthesia over orthodontists' treatment recommendations, was rejected since camouflage predominated and the vignette ranked 8th with respect to influence factor. Here, as with the patient in poor health, respondents (n = 46) commented regarding referral to an oral surgeon or physician to discuss patient concerns. Respondents' behaviour with respect to this vignette seemed reasonable.

Failure to reject null Hypothesis 19, pertaining to the influence of patient indecision over orthodontists' treatment recommendations, was based on a nonsignificant difference between surgical and camouflage options for the indecisive patient. The high influence factor (7th of 23) for this vignette implied that respondents would give the indecisive patient their opinion as to the 'best' treatment option. High frequency of recommendation for completion of the consultative process prior to final decision was an extremely positive factor which offset some of the negative implications of the high influence factor. Despite the compounded difficulties of a borderline orthognathic decision and an indecisive patient, respondents allowed the patient time to gather more information so that the patient could choose their preferred treatment option.

Hypotheses V: Patient psyche

Null Hypothesis 20, regarding influence of patient facial image consistency over orthodontists' treatment recommendations, was rejected. Surgical referral predominated for the patient described as having an isolated inconsistency. Despite rejection of the null hypothesis, respondents' recommendations were consistent with the psychological literature in that an isolated inconsistency makes a patient a potentially good surgical candidate.[24] It could be argued that the patient should still have enjoyed equal presentation of surgery and camouflage options given the borderline nature of the case, but this argument was negated by the low influence factor for this particular vignette.

Failure to reject null Hypothesis 21, regarding the influence of patient self-esteem over orthodontists' treatment recommendations, was based on similar frequency of surgical and camouflage recommendations for the vignette patient with low self-esteem. "No treatment" was not highly recommended. However, as previously mentioned, it was unlikely that the patient would be forced into treatment. Also, this vignette had the lowest influence factor of 23 vignettes. High frequency of psychological referral for the patient with low self-esteem was consistent with the psychological literature[37,40] and might have indicated that respondents felt that with the fluctuations in self-esteem that a surgical patient might experience, the patient with originally low self-esteem would be at greater risk for psychological morbidity.

Failure to reject null Hypothesis 22, regarding orthodontists' recognition of the influence of avoidant versus vigilant coping mechanism over patient post-surgical satisfaction, was based on respondents' lack of knowledge of post-surgical psychological response for the avoidant versus the vigilant coper. There are three possible explanations for respondents' failure to anticipate a favourable post-surgical situation for the avoidant coper (the patient who avoids threat-relevant information[41]). First, the questionnaire item may not have accurately represented coping mechanism: the avoidant coper could have been perceived as inattentive, similar to the vignette patient who did not listen seriously to surgical risks discussion. Second, respondents may not have perceived reactions to surgery based on coping mechanism the same as are represented in the literature.[42] Finally, respondents may not have been familiar with the concept of coping mechanism.

Results were inconclusive with respect to Hypothesis 23, regarding the influence of patient external motivation over orthodontists' treatment recommendations. Thus, failure to reject the null hypothesis was indicated. Considering that other literature supports rejection of the null hypothesis,[35] further research may be indicated. No trend with respect to consistency of treatment recommendation with direction of pressure from the support system was observed. Conclusions could not be made regarding external motivation, other than that it may be situation-dependent. Note that for the vignette related to the minor who wanted a different treatment option than the parents wanted, 30 respondents commented that the decision should be made once the patient reached the age of majority. The data were further discussed under Hypothesis 26 since the vignettes more directly addressed influence of degree of support.

Failure to reject null Hypothesis 24, regarding the influence of patient external life crisis over orthodontists' treatment recommendations, was based on a nonsignificant difference between surgical and camouflage recommendation for the patient hoping to improve a negative life through surgery. This was not supported by the influence factor which ranked 8th of 23. If respondents were concerned about this patient's motivation for surgery one might have expected the camouflage option to predominate over the surgical option, which it did not, and one would have expected frequency of psychological referral to be high, which it was. Frequency of psychological referral was consistent with psychological literature which describes unhealthy expectations that surgery will alter the quality of life events,[35] and with literature describing projection of life events onto a separate problem as negative.[34] Frequency of psychological referral was inconsistent with conflicting literature which does not consider realism of expectations as prerequisite to a successful surgical outcome.[18]

Null Hypothesis 25, regarding differences in treatment recommendations by orthodontists for introverted versus extroverted patients, was rejected based on surgery and psychological referral being recommended more frequently for the introvert than the extrovert. Hypothesis 25 might have been accepted on the basis of the influence factor since the vignettes ranked 16th and 21st of 23. Due to apparent controversy in the literature regarding the effect of intro- or extroversion over post-surgical satisfaction,[27,39] results of the present study are difficult to critique. Greater surgical referral would be inconsistent with psychological literature for introverted male patients, given less tolerance to post-surgical discomfort.[27] Perhaps the respondent was using folk-psychological reasoning, rationalizing that improved facial esthetics would allow the introvert to become more extroverted. Greater psychological referral for the introvert was consistent with the literature pertaining to need for more intensive pre-surgical counselling for introverted versus extroverted men.[27]

Hypotheses VI: Patient support system

Conclusions regarding Hypothesis 26, pertaining to influence of lack of support by the patient's support system over orthodontists' treatment recommendations, depended on the support system component considered. In support of the null hypothesis, all support system vignettes had low to moderate influence factors, and multiple comparisons for the patient whose spouse favoured the surgical option showed no significant difference in frequency of recommendation of surgery versus camouflage. However, surgical recommendation was significantly lower than camouflage in three of the four vignettes considered: for the patient with no support from family, for the patient with a family resemblance, and for the minor whose parents do not support the minor's preferred option. This led to rejection of null Hypothesis 26.

Generally the support system was satisfied by respondents' recommendations: recommending against dramatic facial change in the situation of family resemblance; recommending in accord with parental wishes; and recommending treatment in a neutral fashion for the spousal situation. The latter neutral recommendation was positive from the perspective of allowing patient and support system to resolve their own differences. Making recommendations consistent with the apparent wishes of the support system might have been contrary to findings of a survey of physicians and parents of children with Down's Syndrome in which surgery was more predominant in physicians' recommendations.[17] Respondents who did not satisfy the support system may have expected that a vignette patient would have support persons other than those described in the vignettes, or that the most important factor in satisfaction with treatment was whether the treatment was that preferred by the patient. The two studies are not directly comparable since a parent was making the decision for the child whereas the vignette patient in the present study was directly involved in the decision.

As discussed, null Hypothesis 27, regarding the influence of patient family resemblance over orthodontists' treatment recommendations, was rejected based on multiple comparisons showing camouflage recommendation to predominate. Rejection was not supported by the influence factor, which ranked 20th of 23 vignettes. The combination of treatment recommendation frequencies and influence factor could imply predominance of camouflage only for the percentage of respondents by which the camouflage recommendation exceeded the surgical recommendation. These respondents must have felt potential support system conflict important enough to warrant recommending camouflage rather than surgery.

Hypotheses VII: Oral surgeon traits

Hypotheses 28, 29 and 30 pertained to the influence of surgeon competence, surgeon rapport with the orthodontist, and quality of surgeon explanation of surgical risks to patients, respectively, over orthodontists' treatment recommendations. Failure to reject null Hypotheses 28 and 29 was based on contraindication of further analysis due to sample homogeneity. Failure to reject null Hypothesis 30 was based on a nonsignificant ANOVA. It was reassuring that respondents generally had high regard for the oral surgeon(s) to whom they referred patients. Logically, if this were not the case, another surgeon might be approached. In order to further examine these hypotheses, a different experimental design is indicated. Perhaps there are more important questions that need to be answered with respect to oral surgeons and orthognathic decision-making.

Hypotheses VIII: Psychologist traits

Hypotheses 31 to 33 pertained to the influence of psychologist availability, psychologist expertise and quality of psychologist rapport with orthodontist, respectively, over orthodontists' treatment recommendations. Failure to reject null hypotheses 31 to 33 was based on contraindication of further analysis due to sample homogeneity.

Low frequency of psychological referral within the vignettes, low reported utilization of psychologists by respondents and apparent lack of influence of psychologist availability, expertise and rapport over respondents' treatment recommendations were consistent with the concept that orthognathic surgery patients are generally psychologically well-balanced, or historically at least better balanced than their cosmetic surgery counterparts.[66]

Despite potentially infrequent psychological morbidity in respondents' orthognathic patients, it was reassuring to find responses consistent with psychological literature for four traits (introversion, self-consistency, self-esteem, and unrealistic expectations), while inconsistent for only two (developmental versus traumatic defect and coping mechanism). Perhaps respondents were familiar with most of the psychological literature which was incorporated into the study, or perhaps their folk-psychological reasoning was fairly accurate.

However, results inconsistent with the psychological literature for even two traits are a concern. In the author's opinion, prevention of psychological morbidity in orthognathic patients, particularly the borderline patient, could improve with greater realization by orthodontists of psychological concepts. Such realization could occur through orthodontists' communication with psychologists, perusal of psychological literature or attainment in graduate school curricula. When one considers that the primary difference between a patient who elects to undergo surgery versus a patient who does not lies more in facial self-perception than facial structure,[66] an alternative to surgery for the borderline orthognathic patient becomes apparent: psychological counselling, plus or minus camouflage orthodontics or combined orthodontics and orthognathic surgery.

Applications of the Study

Description of orthognathic decision-making has applications with respect to dental graduate and undergraduate curricula and personal decision analysis. Also, decision description, through identification of situations for which decisions lack consensus, may identify the requirement for database expansion or clarification of decision strategies in certain disciplines.

Attitudes toward risk discussed in the context of the institution could be extrapolated to orthodontic graduate school curricula. "An institution which is familiar with the distinction between a good decision and a good outcome tends to encourage bold decisions, in contrast to an institution which approaches risk as a societal hazard."[5] This philosophy of decision-making may have to be tempered for health professions where risks are to health or even life.

Decision description lays the groundwork for decision analysis. From such analysis, decision algorithms and heuristics can be defined and incorporated into curricula. Slovic's concern is that "Simply warning a judge about a bias may prove ineffective. Like perceptual illusions, many biases do not disappear upon being identified."[45] However, at the very least, decision theory enables a more complete analysis by incorporating uncertainty into the decision problem.[67] According to Hammond, McClelland and Mumpower,[45] decision theory approach educates the decision maker with respect to four things: utility functions; all possible consequences of the alternatives; choosing information important for making the decision; and the qualitative implications of the decision. Decision theory aids communication of reasoning among decision makers. Decision theory "distinguishes... preferences...from judgments about uncertainties...".[45] Decision analysis may reveal "new insights" that result in the discovery of new alternatives.[45]

Practitioners who have been away from academia can evaluate the accuracy of their decision-making. Where their decision-making departs from the ideal, either they are interpreting the literature upon which they base their decisions incorrectly, they are incorporating the literature into an algorithm or heuristic incorrectly, or the literature is inaccurate and merits updating through further research.

Suggestions for Future Research

Clinical study of borderline orthognathic decision-making.

Where results for hypotheses were inconclusive due to a conflict between multiple comparisons or *t*-tests and the influence factor, or due to design limitations, further research to determine whether influence is clinically significant is warranted. Such research might involve direct observation, chart audit or information processing.[44]

Rather than determining whether a patient is influenced by which treatment options are presented, one could determine whether a patient is influenced by how the options and their outcomes are presented. A study of the effect of orthodontists' outcome framing on decisions by orthognathic patients could be performed, patterned after a similar breast cancer study.[68]

Influence of patient traits over orthodontists' borderline orthognathic decisions.

Only a handful of patient traits were examined in the present study. Future research could examine the degree to which dental and skeletal characteristics of the borderline orthognathic patient influence treatment recommendations by the orthodontist, or how multiple patient traits interact to influence decisions.

Influence of support system over potential orthognathic patients' treatment decisions.

In order to apply decision theory to the orthognathic situation, decision participants should be defined. The most likely participants could be revealed through simultaneous interview of support system members around the time that treatment is being selected. Similar work has been done with respect to family fertility decisions.[69]

Traits of orthognathic decision-makers.

Based on the higher order polynomial interactions of graduation year with surgical or camouflage options under Hypothesis 1, an interesting question for future research might be whether the era in which graduate orthodontic education is received, depending on the swing of the 'surgical pendulum', influences treatment recommendation patterns for the duration of orthodontists' careers.

The dispute as to whether risk-propensity is a personality trait or situation-specific[5] seems important to resolve for both treatment provider and orthognathic patient if the orthognathic decision situation is classified as risky. Personality traits thought to be related to risk-propensity could influence choices made by treatment providers and patients with those traits in the risky orthognathic decision situation. Risk-propensity evaluation has applications to patient selection, clinical decision-making, graduate school curricula and computer-interactive diagnosis and treatment planning.

Achievement motivation theory is an aspect of psychological decision theory applied mostly to risky tasks involving skill. Orthognathic treatment represents such a task. Decision-makers in whom the achievement motive dominates the failure-avoidance motive may prefer tasks of moderate risk. Decision-makers dominated by failure-avoidance prefer either low (easy) or high (difficult) risk tasks since easy tasks guarantee success and failure on difficult tasks can always be justified by the excessive difficulty of the task.[5] Future research could be directed toward determination of orthodontists' and oral surgeons' achievement versus failure-avoidance motivation, and whether this influences their treatment of orthognathic patients.

Personality traits which favour good decision-making include "...problem sensitivity, ideational flexibility, emotional maturity, low anxiety level, high self-esteem and self-assurance."[5] Such traits could be assessed in both treatment provider and patient to help maximize the quality of their decisions or realize limitations to good decision-making.

Improving orthognathic decision-making.

Risk can be discussed in the context of open versus closed decision tasks. In the closed decision task the "...decision maker has full knowledge of all the available alternatives and their consequences."[5] In the open decision task, the decision maker initially produces a set of alternatives then "...assesses their possible consequences..."[5] In any orthodontic decision situation, treatment options are designed specifically for the individual patient and the task is thus an open one. Future research could be directed at the nature of the process by which orthodontists produce the set of treatment alternatives and the comprehensiveness of such a list.

Collective orthognathic decision-making might include patient, orthodontist, oral surgeon and support persons. Collective orthognathic decision-making may share psychological traits of collective decision-making in general. One such trait is amplification of preference, a reinforcement effect whereby the larger the group, the greater the chance that majority preference will rule.[3] Future research could determine whether or not the number of support persons and dental professionals brought into a decision should be restricted in the interest of truly objective decision-making. Such investigation would be most relevant to the situation where majority preference conflicts with patient preference, especially if the patient is influenceable.

Another psychological trait of collective decision-making is the risky-shift effect, a shift in risk-taking propensity that has four predominant explanations.[3] First, diffusion of responsibility refers to alleviation of regret when a risky decision with a negative outcome is made by a group versus a single actor. This concept favours involving support persons and other dental professionals in the orthognathic decision as insurance against psychological discomfort in the event of a negative outcome. Second, persuasion refers to "...the assumption that individuals who are dominant in group discussions...tend to be more aggressive and...willing to take risks".[3] The persuasion hypothesis has mixed support but is interesting by virtue of implying that certain 'dominant' patients, orthodontists and oral surgeons may be more inclined to choose or recommend the risky alternative. Third, the relevant information hypothesis refers to caution associated with initial unfamiliarity with a decision task. If this hypothesis holds true for orthognathic decisions, the more detailed the patient's knowledge with respect to surgical risks and benefits, the more appealing the surgical option would become. Last, under the cultural value hypothesis for risk-preferring cultures, group discussion reinforces loyalty to cultural values. Any of the four explanations of risky-shift could be researched in the orthognathic context.

The accepted level of risk may be inversely related to the number of people sharing the activity.[5] In the orthognathic situation, the patient undergoes treatment alone but is supported throughout the decision and treatment to varying degrees. The larger the support group, perhaps the lower risk level the patient would be willing to accept. This too could be researched in the orthognathic context to determine the ideal size of the decision-making group.

Group decision theory may be applicable to the interaction between orthodontist and oral surgeon. Psychological decision research demonstrates that in certain situations a nominal group estimates probabilities better than the individual and the individual estimates probabilities better than a Delphi group. In a nominal group, each individual produces a probability estimate, followed by group discussion, then another individual estimate. In a Delphi group, each individual produces a probability estimate, receives written information regarding the other members' estimates, then repeats the individual estimate.[5] The nominal-individual-Delphi differences indicate a potential advantage of face-to-face discussion versus written communications between orthodontist and oral surgeon regarding projected outcomes of treatment options following their individual consideration of the decision task. Whether face-to-face discussion between orthodontist and oral surgeon is advantageous could be the topic of future research.

Risk perception is affected by time factors.[5] The greater the elapsed time between decision and consequence(s), the lower the risk estimate. This might be particularly pertinent to the orthognathic situation. The elapsed time between decision and consequence is approximately eighteen months and because of this the decision-maker may underestimate risks. An interesting question for future research is whether orthognathic patients' risk estimation changes over the pre-surgical period.

Bayesian and utility approaches are both considered specialist techniques for prescribing optimal decisions. A Bayesian approach could potentially be applied to future research regarding accuracy of probability revision by oral surgeons for negative surgical outcomes.

A computer program has been developed to provide orthodontic advice to the general dentist. The program gives advice which resembles "...that given by the clinician upon whose knowledge it is based when he himself is entering the necessary clinical data."[70] The development of an interactive computer program, based on expanded research into orthognathic decision theory and tailored to the individual orthodontist, would negate the argument that a formal decision model is inappropriate if not representative of the decision-makers' own values.

According to Lewis, Lavell and Simpson,[65] the practitioner may proceed with surgery due to economic pressures or because a case presents a challenge. Decisions made in such disregard to patient preference were not examined in the present study, although the concept was mentioned by one of the ethnographic subjects. Economic pressures were not deemed important in the present study because no financial advantage exists for an orthodontist to recommend surgery over camouflage. The concept of treating a case in a manner which creates challenge could be the subject of future research.

V. CONCLUSION

A broad spectrum of orthodontist, patient, oral surgeon and psychologist traits were examined through case vignette survey research to determine their influence over orthodontists' decisions in borderline orthognathic surgery cases. Specific conclusions regarding orthodontists' decision-making behaviour apply either to the respondent or to the respondent group.

1. Respondents were averse to risks of orthognathic surgery since camouflage orthodontics was generally more highly recommended for patients described in case vignettes than surgery was. This conclusion may require substantiation given the predominance of negative patient attributes in the case vignettes.

2. Surgical recommendation increased linearly with recency of respondent graduation. The interaction of surgical recommendation and respondent graduation year followed a quadratic function and the interaction of camouflage orthodontic recommendation and respondent graduation year followed a cubic function.

3. Respondent knowledge of costs of orthognathic surgery was moderately accurate and such costs were not perceived as a burden to either patients or the provincial health care system.

4. Most respondents believed orthognathic surgery to be justified for a patient severely compromised functionally or esthetically.

5. Tendencies for individual respondents to favour orthognathic surgery or camouflage orthodontic recommendation seemed to exist.

6. Respondent groups who recommended psychological referral frequently also recommended "no treatment" more frequently.

7. Respondents' facial self-image, generally positive from both subjective and 'objective' perspectives, did not influence their treatment recommendations in borderline orthognathic surgery cases.

8. Referral for psychological consultation was generally not frequently recommended by respondents.

9. Patient age influenced respondents' treatment recommendations for a questionnaire item not specifying a borderline patient. Growth modification was recommended up to approximately the age of skeletal maturation, with little possibility of recommendation past age 18. Earliest feasible orthognathic surgery was recommended for a significantly older patient (by approximately 15 months) than was eligible for growth modification. Approximately one third of respondents felt surgery to be an option before the age of 8 years in a patient with a severe defect. Approximately one half of respondents felt there to no age limit to surgery for the older patient.

10. No significant difference occurred between respondents' frequency of recommendation of orthognathic surgery or camouflage orthodontics for patients with the following traits: combined TMJ dysfunction and existing excellent facial esthetics; impatience regarding delay to surgical consultation; apprehension regarding surgery and a spouse who favours the surgical option; indecision regarding choice of treatment option. For the patient with expectations that a positive facial change would have a positive effect on negative life events or for a patient with low self-esteem, the respondent group did not favour orthognathic surgery or camouflage orthodontics. However, the "influence factor" for these latter two vignettes was high, indicating that individual respondents favoured either surgery or camouflage for such patients.

11. Respondents made camouflage orthodontic recommendation significantly more frequently than orthognathic surgery recommendation for patients with the following traits: poor general health; existing excellent facial esthetics; unaccepting of time and cost involved in treatment; a nonsupportive 'support' system; family resemblance; under the age of majority and preferring the surgical option to which the parents object; fearful of the risks of general anaesthetic. Respondents recommended camouflage more frequently than surgery for the patient inattentive to a discussion of surgical risks and for the patient intolerant of discomfort and inconvenience. However, for these latter two patients, the conclusion was reached with less certainty due to a low "influence factor" which indicated that many respondents recommended both surgery and camouflage as treatment options.

12. Respondents made orthognathic surgery recommendation significantly more frequently than camouflage orthodontic recommendation for patients with the following traits: TMJ

dysfunction with skeletal discrepancy as an etiologic contributor; developmental or traumatic defect; introversion; one facial feature inconsistent with an overall positive self-image.

13. Respondents recommended "no treatment" significantly more frequently than either orthognathic surgery or camouflage orthodontics for the uncooperative patient.

14. Recommendations for orthognathic surgery, camouflage orthodontics and psychological referral were consistent with recommendations in the psychological literature for the following traits: introversion (provided that the vignette patient was perceived as male or given that respondents might have made such a generalization); perception of an isolated facial feature inconsistent with a generally positive self-image; low self-esteem; the expectation that negative life events can be improved through treatment (unrealistic motivation).

15. Recommendations for orthognathic surgery, camouflage orthodontics and psychological referral were inconsistent with recommendations in the psychological literature for the following traits: developmental versus traumatic defect; avoidant versus vigilant coping mechanism.

16. Treatment recommendations for items related to external motivation (treatment motivated by others) were situation-dependent.

17. Orthodontists' subjective evaluation of oral surgeon availability did not influence treatment recommendations. Other traits of available oral surgeons (competence, rapport) had no influence over treatment recommendations by respondents. This could be attributed to sample homogeneity with respect to perception of oral surgeon competence (good) and quality of rapport with orthodontist (good). Quality of oral surgeon discussion of surgical risks with patient was not perceived in a homogeneous fashion by respondents, but still had no influence over treatment recommendation.

18. Respondent perception of psychologist availability, expertise and rapport with the respondent had no influence over treatment recommendations by respondents. This could be attributed to lack of respondent familiarity with local psychologists due to low frequency of recommendation of psychological referral.

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APPENDIX I Ethnographic Survey Results

Note that subjects were prompted with open-ended questions regarding patient, orthodontist and oral surgeon characteristics which they felt would influence orthodontists' treatment recommendations. Subjects' responses were recorded in short-hand. Comments applied to the present study are **bold**-lettered.

SUBJECT 1 (M. SC., 5 YEARS CLINICAL ORTHODONTIC EXPERIENCE)

-number one is patients desires
-explain the options to the patient as well as facial result and compromised result
-patient age, if over 45, hesitate with surgery, if under 12, go conservative

surgeon characteristics:
-access
-not a big deal if long distance for travel
-not **explain** procedure and **potential risks**, assuming equal **competence**
-quality of orthodontist **communication with patient**, whether prepared to share treatment planning responsibilities
-fees (1500 - 3000 over and above AHC, other provinces likely not better than Alberta)
-if surgeon in your town not competent and patient not prepared to travel...consider not accepting case if you think surgery is the best thing

-never overtly try to sway patient

patient characteristics:
-not prepared to **seriously evaluate consequences** of treatment, no surgery
-any **reluctance** regarding surgery, no surgery
-motivated, want surgery...assess, ask patient. Reinforce that no option of changing mind, no option of backing out of surgery
patient who becomes negative:
-only had one unhappy patient. Problem, she **didn't listen** and was **reluctant to discuss** pros and cons
patient who wants to back out:
-hesitant initially
-treated for function not esthetics, eg. **TMJ** case, feel trapped because alternative is wearing splint for rest of life

-patients who choose to change appearance make out better

-positive patient has no reservations up front

-**child** patient conservative bias, may be less ideal facial result
-**adolescent-** still address parent, minimal trouble...bounce back, not much complaint about adverse effects, complain less than adults

-some orthodontists bias to adolescent female facial esthetics

-if borderline case not significantly going to change esthetics, would lean strongly non-surgical. **Surgery bigger risk** than camouflage for TMJ inducement

SUBJECT 2 (M. SC. STUDENT, THIRD YEAR)
-#1 patient's decision
-want patient to consider morbidity, surgical risk, surgical relapse, few days incapacitation, travel involved, surgeons fees
-non-surgical want patient to consider esthetic/functional compromises with camouflage, relapse potential, different treatment time, scarring with different surgical techniques

patient attitude toward:
-surgery, hospital, **finance**

-surgeon would only influence decision whom to refer to, might be some distance

-patient wants orthodontist to decide...subject 2 would refuse. Would give referral for surgery then come back to orthodontist and go back and forth until decide

-despite office overhead, subject 2 would make no decisions for patient

poor patient:
-dependent personality rather than assertive or neutral **(put the decision on your shoulders)**
unhappy patient post-surgically:
-**demanding**, aggressive, female, chief complaint not explored enough

good patient:
-**cooperative**, takes responsibility for own health care

patient now reluctant for surgery:
-review options, might be worse off than before if no surgery, start again with compromise treatment

SUBJECT 3 (M. SC. STUDENT, FIRST YEAR)

-#1 patient desires
-if patient willing to accept compromise, don't push surgery
-total length treatment time (surgery increases time requirement)

surgeon:
-availability, technique, patient comfort (wired shut 6-7 weeks versus rigid fixation), **experience, personality** conflict, not taking his share of responsibility, surgeon demeanour, amount of time until appointment available

patient:
-if they feel it'll **change their life**
-introvert if not happy with result, difficult to adjust
-extrovert wouldn't benefit
-how well they handle **discomfort and annoyance** eg whiny candidate not good

patient **now anxious:**
-good preparation at outset
-have plan in case patient backs out, take case in opposite direction, try to assess early
-can't force patient

-orthodontists' own opinion not significant regarding surgery, subject 3 won't talk patient into it

SUBJECT 4 (M. SC. STUDENT, SECOND YEAR)

-negative previous experience of orthodontist and how recent, eg. paraesthesia and patient says they'd never have it done again
-geographic proximity to surgeon
-surgeon **busyness**
-cost to patient
-recent memory of poor result with surgery
-skill and patient management skills of surgeon
-orthodontist's own level of busyness (although we might deny it) eg. increased compensation for surgical case might make you tend to do them vs if weren't being sufficiently compensated
-patient **physical** and dental **health** /IQ status (eg if not a 'sophisticated consumer' (judged by the way they talk) wouldn't bother

-what the patient desires from treatment (**expectations**)
-diagnostic set-up
-quality and stability of results and patient morbidity

-if can satisfy without surgery, don't do

-borderline case can try non-surgical and switch prn (not so vital to start setting up for surgery at outset)
-gut feelings re finances, cooperation usually wrong

psychological problems:
-can pick up right away
-refer to another orthodontist
-increase fee, signed consent, careful records
-subject 4 hasn't had access to psychological services for patients
-not orthodontist's place to send to psychologist (unless TMJ)
-if someone unbalanced enough to need psychology referral, shouldn't do surg
-psych referral if they figure surgery is going to **change their life**

SUBJECT 5 (M. SC. STUDENT, SECOND YEAR)

-patient **cooperation**
-patient **growth**
-decision between patient and yourself
-patient **informed** decision
-how easy would it be to camouflage
-does camouflage conflict with patient profile
-patient priorities
-systemic contraindications (**medical**)
-may have to sacrifice occlusion/profile
-poor patient management case-surgical and non-surgical both will be dissatisfied
-don't have to like the patient to work on them...it's a job
-would get psych consult if psych a problem
-expectations - will it make them more socially acceptable/employable
-are they **capable of informed decision** (let them think about it for awhile)
-never pressure decision...**give them time** (at least a week...month...year)
-rural patient - still present surgical option and patient has option to travel for surgery. Maybe more camouflage.
-surgeon view of optimal facial esthetics and how extensive the surgery will be ...still patient's decision
-morbidity - present general risks. Surgeon should tell actual %'s etc

-borderline is grey area (continuum)
-orthodontist's own skill
-even as first year grad would **try camouflage**, warn of potential surgery

APPENDIX II Commitment to Confidentiality

As a member of the research team involved in the study of "Orthodontist Predisposition in Orthognathic Decision Making" (University of Alberta Division of Orthodontics 1991) I vow to:

1) refrain from discussion of data in association with any particular respondent's name, with the exception of the open discussion related to questionnaire design at the pre-test stage,

2) attempt to ensure that I do not allow anyone not directly involved with theis research (i.e. who has not signed a similar affidavit) access to material which will associate a respondent with their responses.

____
Name (please print)

____
Signature

____
Signature of Witness

____
Date (please print D-M-Y)

APPENDIX III Introductory Letter to First Mail-out

University of Alberta
Edmonton

Faculty of Dentistry

Canada T6G 2N8

Dentistry Pharmacy Centre

September 16, 1991

title~ first name~ last name~
address~
city~, province~ postal code~

Dear Dr. last name~:

CELEBRATING 75 Years and Forward 1917-1992

The enclosed questionnaire is sent to you as part of a study designed to:

1) describe Canadian orthodontists,
2) determine the facilities available to Canadian orthodontists,
3) examine treatment planning decisions by the Canadian orthodontist.

Fund for Dentistry Investment in Excellence

Of these, the third is expected to produce particularly interesting results. A variety of general and specialized medical groups have been similarly examined, but as yet, orthodontic minds have not received such rich attention. In the dawn of computer diagnostics, this research is particularly timely since the computer we most readily access is our own mind.

This study is performed under the auspices of the University of Alberta Division of Orthodontics in partial fulfillment of my M. Sc. (orthodontics) thesis requirement. The study is sponsored by the McIntyre Fund at the University of Alberta. Application has been made to the Canadian Foundation for the Advancement of Orthodontics for additional support.

The survey will take you about 45 minutes to complete. Your participation is voluntary and you may refrain from responding to questions if you wish.

Your confidentiality will be protected. You have been assigned an ID number for mailing purposes. Once maximum response has been achieved, the link between your name and ID number will be destroyed by me. In addition, members of the research team have committed themselves in writing to maintain your confidentiality.

As you probably realize, the population of Canadian orthodontists is small. Your participation would greatly enhance the accuracy of our results.

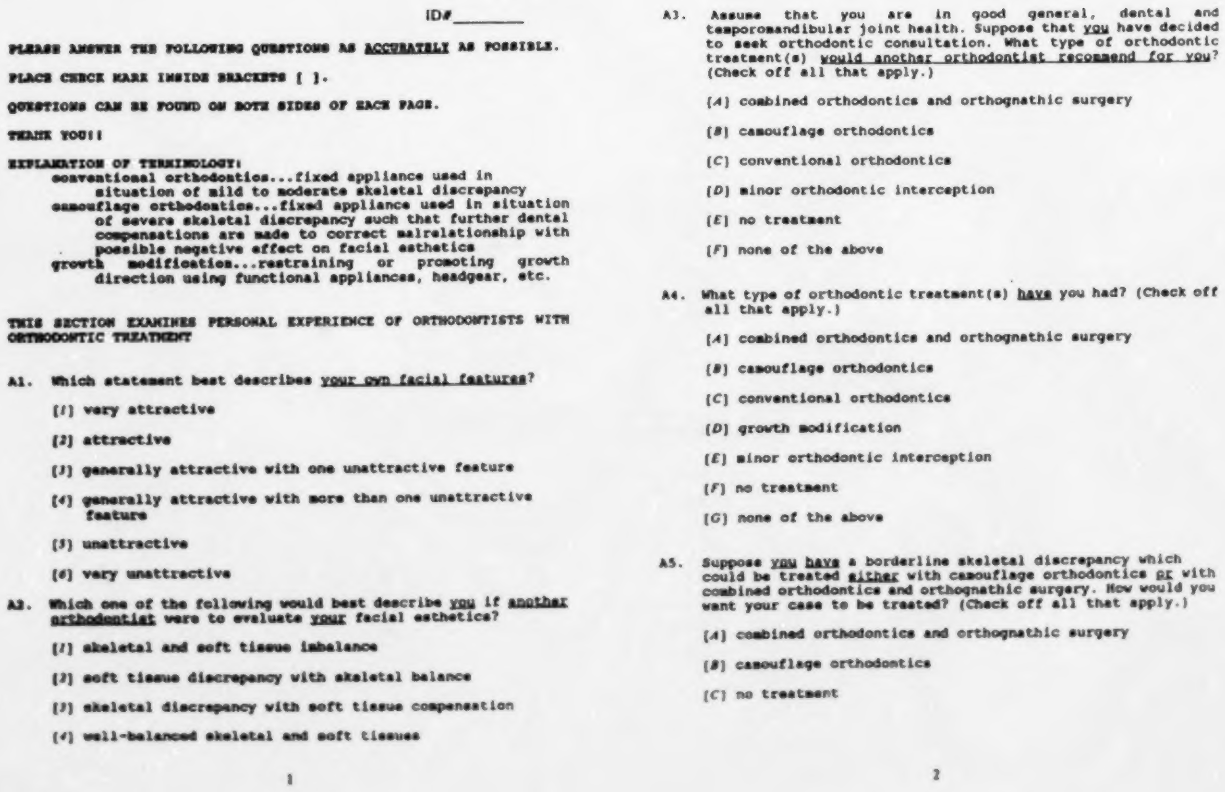
Thanks, in advance, for your help with this research endeavor.

Kindest regards,

Nancy Weaver
Graduate Student, Division of Orthodontics

APPENDIX IV Questionnaire

Note that some codes have been added to the questionnaire and it has been photo-reduced 50%.



ID#________

PLEASE ANSWER THE FOLLOWING QUESTIONS AS ACCURATELY AS POSSIBLE.

PLACE CHECK MARK INSIDE BRACKETS [ ].

QUESTIONS CAN BE FOUND ON BOTH SIDES OF EACH PAGE.

THANK YOU!!

EXPLANATION OF TERMINOLOGY:
conventional orthodontics...fixed appliance used in situation of mild to moderate skeletal discrepancy
camouflage orthodontics...fixed appliance used in situation of severe skeletal discrepancy such that further dental compensations are made to correct malrelationship with possible negative effect on facial esthetics
growth modification...restraining or promoting growth direction using functional appliances, headgear, etc.

THIS SECTION EXAMINES PERSONAL EXPERIENCE OF ORTHODONTISTS WITH ORTHODONTIC TREATMENT

A1. Which statement best describes your own facial features?

- [*1*] very attractive
- [*2*] attractive
- [*3*] generally attractive with one unattractive feature
- [*4*] generally attractive with more than one unattractive feature
- [*5*] unattractive
- [*6*] very unattractive

A2. Which one of the following would best describe you if another orthodontist were to evaluate your facial esthetics?

- [*1*] skeletal and soft tissue imbalance
- [*2*] soft tissue discrepancy with skeletal balance
- [*3*] skeletal discrepancy with soft tissue compensation
- [*4*] well-balanced skeletal and soft tissues

1

A3. Assume that you are in good general, dental and temporomandibular joint health. Suppose that you have decided to seek orthodontic consultation. What type of orthodontic treatment(s) would another orthodontist recommend for you? (Check off all that apply.)

- [*A*] combined orthodontics and orthognathic surgery
- [*B*] camouflage orthodontics
- [*C*] conventional orthodontics
- [*D*] minor orthodontic interception
- [*E*] no treatment
- [*F*] none of the above

A4. What type of orthodontic treatment(s) have you had? (Check off all that apply.)

- [*A*] combined orthodontics and orthognathic surgery
- [*B*] camouflage orthodontics
- [*C*] conventional orthodontics
- [*D*] growth modification
- [*E*] minor orthodontic interception
- [*F*] no treatment
- [*G*] none of the above

A5. Suppose you have a borderline skeletal discrepancy which could be treated either with camouflage orthodontics or with combined orthodontics and orthognathic surgery. How would you want your case to be treated? (Check off all that apply.)

- [*A*] combined orthodontics and orthognathic surgery
- [*B*] camouflage orthodontics
- [*C*] no treatment

2

ID#________

THESE QUESTIONS CONCERN ORTHODONTIST OPINION REGARDING COST OF ORTHOGNATHIC SURGERY

B1. **To what degree do you consider the cost of orthognathic surgery a burden to your typical orthognathic patient? (If your health care system pays for a portion of the surgery, assume that the treatment involves the average cost that any of your orthognathic patients would be expected to pay.)**

[*1*] very high degree

[*2*] high degree

[*3*] average degree

[*4*] low degree

[*5*] very low degree

[*0*] not applicable... health care pays total cost

[*7*] don't know

B2. **To what degree do you consider the cost of orthognathic surgery a burden to your health care system? (Again, assume a treatment of average cost.)**

[*7*] don't know

[*0*] not applicable... not funded by health care system

[*5*] very low degree

[*4*] low degree

[*3*] average degree

[*2*] high degree

[*1*] very high degree

B3. Which statement(s) best describe(s) how you feel regarding the cost of orthognathic surgery? (Check off all that apply.)

[*A*] the cost of orthognathic surgery is justified in cases of severely compromised function

[*B*] the cost of orthognathic surgery is justified in cases of moderately compromised function

[*C*] the cost of orthognathic surgery is justified in cases of mildly compromised function

[*D*] the cost of orthognathic surgery is justified in cases of severely compromised esthetics

[*E*] the cost of orthognathic surgery is justified in cases of moderately compromised esthetics

[*F*] the cost of orthognathic surgery is justified in cases of mildly compromised esthetics

[*G*] the cost of orthognathic surgery is unjustified

B4. What percentage of the cost of orthognathic surgery does your health care system fund?

[*7*] don't know

[*0*] 0% of total cost of any surgical procedure

[*4*] less than 50% of total cost of any surgical procedure

[*3*] 50% of total cost of any surgical procedure

[*2*] more than 50% of total cost of any surgical procedure

[*1*] 100% of total cost of any surgical procedure

ID#________

B5. What component(s) of orthognathic surgical procedures does your health care system fund? (Check off all that apply.)

[*A*] two jaws

[*B*] one jaw

[*C*] genioplasty

[*D*] anaesthetic

[*E*] additional anaesthetic

[*F*] component(s) not included in the above list

[*G*] no component

[*H*] don't know

B6. What proportion of your orthognathic patients would require surgical procedures for which the cost exceeds the allowance given by your health care system?

[*1*] all orthognathic patients

[*2*] more than half of orthognathic patients

[*3*] half of orthognathic patients

[*4*] less than half of orthognathic patients

[*8*] no orthognathic patient

[*7*] don't know

B7. How important are surgeon's fees in your decision regarding to whom you refer your orthognathic patients?

[*1*] very important

[*2*] important

[*3*] unimportant

[*4*] very unimportant

THIS SECTION DETERMINES WHETHER ORTHODONTISTS PERCEIVE AGE RESTRICTIONS ON THE TREATMENTS THEY ADVISE

C1. Please indicate the one average skeletal age (in years) after which you would NO LONGER consider growth modification a treatment option for the young patient:

if the patient is MALE...

☐ 8	☐ 9	☐ 10	☐ 11	☐ 12	☐ 13
☐ 14	☐ 15	☐ 16	☐ 17	☐ 18	

if the patient is FEMALE...

☐ 8	☐ 9	☐ 10	☐ 11	☐ 12	☐ 13
☐ 14	☐ 15	☐ 16	☐ 17	☐ 18	

or...

☐ orthopedic changes can be obtained beyond age 18 for a patient of either sex

C2. Please indicate the one earliest average skeletal age (in years) at which you would consider orthognathic surgery a treatment option for the young patient:

if the patient is FEMALE...

☐ 8	☐ 9	☐ 10	☐ 11	☐ 12	☐ 13
☐ 14	☐ 15	☐ 16	☐ 17	☐ 18	☐ 19
☐ 20	☐ 21	☐ 22	☐ 23	☐ 24	☐ 25

if the patient is MALE...

☐ 8	☐ 9	☐ 10	☐ 11	☐ 12	☐ 13
☐ 14	☐ 15	☐ 16	☐ 17	☐ 18	☐ 19
☐ 20	☐ 21	☐ 22	☐ 23	☐ 24	☐ 25

additionally...

☐ orthognathic surgery is a good option before age 8 in a patient of either sex given sufficient severity of the problem (eg. congenital birth defect)

ID# ________

C3. Please indicate the one average chronological age range after which you would NOT recommend orthognathic surgery for the older patient:

If the patient is MALE...

☐ 30-34 ☐ 35-39 ☐ 40-44 ☐ 45-49
☐ 50-54 ☐ 55-59 ☐ 60-64 ☐ 65-69

If the patient is FEMALE...

☐ 30-34 ☐ 35-39 ☐ 40-44 ☐ 45-49
☐ 50-54 ☐ 55-59 ☐ 60-64 ☐ 65-69

OR...

☐ age is not a restriction in selecting the surgical option for the older patient of either sex given sufficient severity of the problem

---

THIS SECTION INVESTIGATES YOUR APPROACH BASED ON THE NATURE OF THE PATIENT'S SITUATION

D1. Patient A has a developmental defect for which orthognathic surgery could provide facial esthetic improvement. The accompanying malocclusion could be resolved either using camouflage orthodontics or combined orthodontics and orthognathic surgery.

What treatment(s) would you recommend? (Check off all that apply.)

[A] combined orthodontics and orthognathic surgery

[B] camouflage orthodontics

[C] no treatment

[D] delay treatment decision 6 months

[E] refer for consultation with other dental specialist(s)

[F] refer for second orthodontic opinion

[G] refer for consultation with psychologist

[Z] other (Please specify: ________________________________)

ID#________

D2. Patient B has a recent traumatic defect for which orthognathic surgery could provide facial esthetic improvement. The accompanying traumatically-induced malocclusion could be resolved using either camouflage orthodontics or combined orthodontics and orthognathic surgery.

What treatment(s) would YOU recommend? (Check off all that apply.)

[*A*] combined orthodontics and orthognathic surgery

[*B*] camouflage orthodontics

[*C*] no treatment

[*D*] delay treatment decision 6 months

[*E*] refer for consultation with other dental specialist(s)

[*F*] refer for second orthodontic opinion

[*G*] refer for consultation with psychologist

[ ] other (Please specify:_________________________________)

D3. Patient C has a skeletal discrepancy and malocclusion which have been diagnosed as contributing to this patient's moderate to severe TMJ dysfunction.

What treatment(s) would YOU recommend? (Check off all that apply.)

[*A*] combined orthodontics and orthognathic surgery

[*I*] TMJ surgery

[*B*] camouflage orthodontics

[*J*] conservative TMJ therapy (eg. occlusal splint)

[*C*] no treatment

[*E*] refer for consultation with other dental specialist(s)

[*G*] refer for consultation with psychologist

[ ] other (Please specify:_________________________________)

D4. Patient D has excellent facial esthetics. However, this patient's dental esthetics are not ideal and a skeletal discrepancy exists. Due to the borderline nature of the skeletal discrepancy, treatment could be approached using either camouflage orthodontics or combined orthodontics and orthognathic surgery. Patient D is concerned about maintaining existing excellent facial esthetics.

What treatment(s) would YOU recommend? (Check off all that apply.)

[*A*] combined orthodontics and orthognathic surgery

[*B*] camouflage orthodontics

[*C*] no treatment

[*D*] delay treatment decision 6 months

[*E*] refer for consultation with other dental specialist(s)

[*F*] refer for second orthodontic opinion

[*G*] refer for consultation with psychologist

[ ] other (Please specify:_________________________________)

ID#________

D5. Patient E has a borderline skeletal discrepancy which could be treated either with camouflage orthodontics or combined orthodontics and orthognathic surgery. This patient desires an esthetic improvement and seems willing to choose whichever option will give the most positive facial change. Patient E seems to feel that such a change might have a positive effect given the negative events which have been occurring in this patient's life lately.

Which treatment option(s) would you present to this patient? (Check off all that apply.)

[*A*] combined orthodontics and orthognathic surgery

[*B*] camouflage orthodontics

[*C*] no treatment

[*D*] delay treatment decision 6 months

[*E*] refer for consultation with other dental specialist(s)

[*F*] refer for second orthodontic opinion

[*G*] refer for consultation with psychologist

[ ] other (Please specify:________________________________)

D6. Patient F has a borderline skeletal discrepancy and malocclusion which could be treated either with camouflage orthodontics or with combined orthodontics and orthognathic surgery. At the consultation Patient F does not listen seriously to your discussion of the risks and benefits of surgery. The decision seems to have already been made based on reports by friends who have had orthognathic surgery.

Which treatment option(s) would you present to this patient? (Check off all that apply.)

[*A*] combined orthodontics and orthognathic surgery

[*B*] camouflage orthodontics

[*C*] no treatment

[*D*] delay treatment decision 6 months

[*E*] refer for consultation with other dental specialist(s)

[*F*] refer for second orthodontic opinion

[*G*] refer for consultation with psychologist

[ ] other (Please specify:________________________________)

ID# ________

D7. Patient G is in good dental health but in poor general health. This patient has a borderline skeletal discrepancy which could be treated either with camouflage orthodontics or with combined orthodontics and orthognathic surgery.

Which treatment option(s) would you present to this patient? (Check off all that apply.)

[*A*] combined orthodontics and orthognathic surgery

[*B*] camouflage orthodontics

[*C*] no treatment

[*D*] delay treatment decision 6 months

[*E*] refer for consultation with other dental specialist(s)

[*F*] refer for second orthodontic opinion

[*G*] refer for consultation with psychologist

[ ] other (Please specify: ________________________________)

D8. Patient H has excellent facial esthetics. Treatment of the malocclusion and accompanying borderline skeletal discrepancy could be approached with either camouflage orthodontics or combined orthodontics and orthognathic surgery. However, the skeletal discrepancy has been identified as one of the etiologic factors in this patient's moderate to severe TMJ dysfunction. Patient H would like to maintain existing excellent facial esthetics.

What treatment(s) would you recommend? (Check off all that apply.)

[*A*] combined orthodontics and orthognathic surgery

[*I*] TMJ surgery

[*B*] camouflage orthodontics

[*J*] conservative TMJ therapy (eg. an occlusal splint)

[*C*] no treatment

[*E*] refer for consultation with other dental specialist(s)

[*G*] refer for consultation with psychologist

[ ] other (Please specify: ________________________________)

ID#________

D9. Patient I is an extroverted adult in good general and dental health. Patient I has a borderline skeletal discrepancy which could be treated with either camouflage orthodontics or with combined orthodontics and orthognathic surgery.

Which treatment option(s) would you present to this patient? (Check off all that apply.)

[A] combined orthodontics and orthognathic surgery

[B] camouflage orthodontics

[C] no treatment

[D] delay treatment decision 6 months

[E] refer for consultation with other dental specialist(s)

[F] refer for second orthodontic opinion

[G] refer for consultation with psychologist

[ ] other (Please specify:______________________________)

D10. Patient J is in good dental and general health. This patient keeps physically fit and is always well-dressed, which leads you to conclude that Patient J has a generally good self-image. At the consultation, this patient confides self-consciousness about the prominence of one jaw. Patient J's skeletal discrepancy is borderline and could be treated either with camouflage orthodontics or with combined orthodontics and orthognathic surgery.

Which treatment option(s) would you present to this patient? (Check off all that apply.)

[A] combined orthodontics and orthognathic surgery

[B] camouflage orthodontics

[C] no treatment

[D] delay treatment decision 6 months

[E] refer for consultation with other dental specialist(s)

[F] refer for second orthodontic opinion

[G] refer for consultation with psychologist

[ ] other (Please specify:______________________________)

ID#_______

D11. Patient K is an introverted adult in good general and dental health. Patient K has a borderline skeletal discrepancy which could be treated with either camouflage orthodontics or with combined orthodontics and orthognathic surgery.

Which treatment option(s) would you present to this patient? (Check off all that apply.)

[A] combined orthodontics and orthognathic surgery

[B] camouflage orthodontics

[C] no treatment

[D] delay treatment decision 6 months

[E] refer for consultation with other dental specialist(s)

[F] refer for second orthodontic opinion

[G] refer for consultation with psychologist

[ ] other (Please specify:______________________________)

D12. Patient L has friends who have had orthodontic treatment and friends who have had orthodontics in combination with orthognathic surgery. Patient L realizes that orthodontic appliances can be uncomfortable and that after orthognathic surgery some inconveniences are imposed upon the patient. Discomfort and inconvenience do not appeal to patient L.

Which treatment option(s) would you present to this patient? (Check off all that apply.)

[A] combined orthodontics and orthognathic surgery

[B] camouflage orthodontics

[C] no treatment

[D] delay treatment decision 6 months

[E] refer for consultation with other dental specialist(s)

[F] refer for second orthodontic opinion

[G] refer for consultation with psychologist

[ ] other (Please specify:______________________________)

ID#________

D13. Patient M has a borderline skeletal discrepancy and malocclusion for which the treatment could include either camouflage orthodontics or combined orthodontics and orthognathic surgery. To date, this patient has had separators placed, but showed up at the banding appointment with all separators missing, having neglected to notify your office when they fell out. In addition, Patient M was given a trial period of two weeks to improve oral hygiene, but failed to. No fixed appliances have been placed, no teeth have been extracted yet.

At this point, which option(s) would you proceed with? (Check off all that apply.)

[*A*] combined orthodontics and orthognathic surgery

[*B*] camouflage orthodontics

[*C*] no treatment

[*D*] delay treatment decision 6 months

[*E*] refer for consultation with other dental specialist(s)

[*F*] refer for second orthodontic opinion

[*G*] refer for consultation with psychologist

[ ] other (Please specify:________________________________)

D14. Patient M has a borderline skeletal discrepancy for which either camouflage orthodontics or combined orthodontics and orthognathic surgery could be the treatment. Patient M realizes that combined orthodontic/ orthognathic treatment time is lengthy and more expensive than conventional orthodontic treatment. Patient M grumbles to you, asking if there is any way you can decrease the treatment time or expense.

Which treatment option(s) would you be willing to proceed with for this patient? (Check off all that apply.)

[*A*] combined orthodontics and orthognathic surgery

[*B*] camouflage orthodontics

[*C*] no treatment

[*D*] delay treatment decision 6 months

[*E*] refer for consultation with other dental specialist(s)

[*F*] refer for second orthodontic opinion

[*G*] refer for consultation with psychologist

[ ] other (Please specify:________________________________)

ID#________

D15. Patient O has a borderline skeletal discrepancy for which the treatment approach could involve either conventional orthodontics or combined orthodontics and orthognathic surgery. This patient expresses some fear of the risks associated with general anaesthesia.

Which treatment option(s) would you present to this patient? (Check off all that apply.)

[*A*] combined orthodontics and orthognathic surgery

[*B*] camouflage orthodontics

[*C*] no treatment

[*D*] delay treatment decision 6 months

[*E*] refer for consultation with other dental specialist(s)

[*F*] refer for second orthodontic opinion

[*G*] refer for consultation with psychologist

[ ] other (Please specify:________________________________)

D16. Patient P has a skeletal discrepancy and malocclusion which could be treated with either camouflage orthodontics or combined orthodontics and orthognathic surgery. This patient gives you the impression of having generally low self-esteem.

Which treatment option(s) would you present to this patient? (Check off all that apply.)

[*A*] combined orthodontics and orthognathic surgery

[*B*] camouflage orthodontics

[*C*] no treatment

[*D*] delay treatment decision 6 months

[*E*] refer for consultation with other dental specialist(s)

[*F*] refer for second orthodontic opinion

[*G*] refer for consultation with psychologist

[ ] other (Please specify:________________________________)

D17. Patient Q is an adult patient who presents with a skeletal discrepancy and malocclusion for which the treatment could include either camouflage orthodontics or combined orthodontics and orthognathic surgery. You have presented the treatment options to this patient. Patient P is having difficulty making the decision as to which treatment approach to pursue. Patient P seems to want you to recommend the choice YOU would make if YOU were the patient.

What will you do now with respect to Patient P's treatment recommendation? (Please check off all that apply.)

[*A*] recommend combined orthodontics and orthognathic surgery

[*B*] recommend camouflage orthodontics

[*K*] recommend no treatment

[*C*] recommend that Patient Q delay the treatment decision until the consultative process has been completed with those health care professionals to whom referral has been made

[*L*] recommend that Patient Q delay the treatment decision until thorough discussion with family and/or spouse

[*M*] recommend that Patient Q delay the treatment decision until discussing the risks and benefits of orthognathic surgery with other patients who have undergone such surgery recently

[*N*] recommend that Patient Q delay the treatment decision until discussing the risks and benefits of orthognathic surgery with other patients who underwent such surgery and have attained final healing

ID#________

THIS SECTION EXAMINES STRENGTH OF FAMILY SUPPORT FOR TREATMENT

E1. Patient R is an adult patient considering orthodontic treatment for a borderline skeletal discrepancy for which the treatment could include either camouflage orthodontics or combined orthodontics and orthognathic surgery. The spouse and family of this patient feel that treatment is not justified and do not support Patient R's decision to seek treatment.

What treatment option(s) would you present to this patient? (Check off all that apply.)

[A] combined orthodontics and orthognathic surgery

[B] camouflage orthodontics

[C] no treatment

[D] delay treatment decision 6 months

[E] refer for consultation with other dental specialist(s)

[F] refer for second orthodontic opinion

[G] refer for consultation with psychologist

[ ] other (Please specify:________________________________)

E2. Patient S facially closely resembles several relatives of the same sex, including the same-sex parent and one sibling. Patient S also has a borderline skeletal discrepancy which could be treated with either camouflage orthodontics or orthodontics in combination with orthognathic surgery.

Which treatment option(s) would you present to this patient? (Check off all that apply.)

[A] combined orthodontics and orthognathic surgery

[B] camouflage orthodontics

[C] no treatment

[D] delay treatment decision 6 months

[E] refer for consultation with other dental specialist(s)

[F] refer for second orthodontic opinion

[G] refer for consultation with psychologist

[ ] other (Please specify:________________________________)

ID#________

E3. Patient T has a borderline skeletal discrepancy for which the treatment approach could be either camouflage orthodontics or combined orthodontics and orthognathic surgery. Patient T is a minor and the treatment decision will be significantly influenced by the parents' wishes. The parents feel that orthognathic surgery is not indicated, the patient disagrees.

Which treatment option(s) would you present to this patient and the family members who will participate in the treatment decision? (Check off all that apply.)

[A] combined orthodontics and orthognathic surgery

[B] camouflage orthodontics

[C] no treatment

[D] delay treatment decision 6 months

[E] refer for consultation with other dental specialist(s)

[F] refer for second orthodontic opinion

[G] refer for consultation with psychologist

[ ] other (Please specify:________________________________)

E4. Patient U has a malocclusion and borderline skeletal discrepancy for which either camouflage orthodontics or combined orthodontics and orthognathic surgery could be the treatment approach. Patient U is uncomfortable about the prospect of surgery but has made a tentative decision to proceed with the surgical approach. This decision seems to have been made to satisfy Patient U's spouse, who favoured the surgical approach.

At this point, which treatment option(s) would you emphasize to the patient prior to the final decision? (Check off all that apply.)

[A] combined orthodontics and orthognathic surgery

[B] camouflage orthodontics

[C] no treatment

[D] delay treatment decision 6 months

[E] refer for consultation with other dental specialist(s)

[F] refer for second orthodontic opinion

[G] refer for consultation with psychologist

[ ] other (Please specify:________________________________)

ID#________

THIS SECTION EXAMINES PATIENT BEHAVIOUR WHEN THE CHOICE HAS BEEN MADE TO PROCEED WITH SURGERY

F1. Patient V is scheduled for orthognathic surgery within the next few months. This patient seems very interested in the surgical risks. Although both you and the oral surgeon have reviewed these risks, Patient V has questioned you in detail regarding them at the last few presurgical appointments.

What is the quality of this patient's immediate post-surgical psychological response likely to be?

[5] very poor

[4] poor

[3] average

[2] good

[1] very good

[7] don't know

F2. Patient W is scheduled for orthognathic surgery within the next few months. Surgical risks were discussed at the outset of treatment. The patient asked questions at the time but has had no further questions. When you remind Patient W of precautions to be taken against surgical risks at the time of surgery, this patient listens to you briefly then chats with you about other things.

What is the quality of this patient's immediate post-surgical psychological response likely to be?

[1] very good

[2] good

[3] average

[4] poor

[5] very poor

[6] don't know

F3. Patient X's surgery is scheduled for this month. This patient is suffering from pre-surgical anxiety and would prefer not to proceed with the surgery.

What option(s) do you have now? (Check off all that apply.)

[8] change treatment plan to camouflage option if possible and inform patient that results may be severely compromised both functionally and esthetically

[O] try to convince patient that surgery must be followed through with due to the significant dental changes already made which are likely unrecoverable

[G] refer patient for psychological consultation prior to making decision as to which course of treatment to pursue

[P] suspend treatment and have patient sign release form

[ ] other (Please specify:________________________________)

THE FOLLOWING QUESTIONS EXAMINE ORAL SURGERY SERVICES AVAILABLE TO ORTHODONTISTS

IF YOU HAVE A SATELLITE CLINIC, PLEASE RESPOND WHERE INDICATED. IF YOU DO NOT HAVE A SATELLITE CLINIC, PLEASE IGNORE QUESTIONS PERTAINING TO SATELLITE CLINICS.

G1. How would you judge availability of oral surgeons who routinely perform orthognathic surgery in your practice area?

principal office	satellite office
[1] excellent	[ ] excellent
[2] good	[ ] good
[3] fair	[ ] fair
[4] poor	[ ] poor

ID#________

G2. How long after the initial orthodontic consultation do you prefer to book the initial surgical consultation for your borderline orthognathic patients?

[*1*] before making the decision whether surgery will be part of the treatment

[*2*] after orthodontic treatment has begun, so I can better determine the feasibility of camouflage orthodontics

[*3*] once camouflage orthodontics has proven unfeasible

[*4*] when a certain proportion of the pre-surgical orthodontics has been completed

[*5*] other (Please specify:________________________________)

G3. How much of a delay do you experience between the decision to send the patient for initial surgical consultation and the actual consultation?

principal office	satellite office
[ ] 0 to 1 month	[ ] 0 to 1 month
[ ] 1 to 2 months	[ ] 1 to 2 months
[ ] 2 to 3 months	[ ] 2 to 3 months
[ ] 3 to 4 months	[ ] 3 to 4 months
[ ] 4 to 5 months	[ ] 4 to 5 months
[ ] 5 to 6 months	[ ] 5 to 6 months
[*7*] more than 6 months	[ ] more than 6 months

G4. Suppose there will be a 6 month delay between initial orthodontic consultation and initial surgical consultation for Patient Y, who has a borderline skeletal discrepancy for which either camouflage orthodontics or combined orthodontics and orthognathic surgery could be performed. This patient is anxious to start treatment as soon as possible.

Which treatment option(s) would you present to this patient? (Check off all that apply.)

[*A*] combined orthodontics and orthognathic surgery

[*B*] camouflage orthodontics

[*C*] no treatment

[*D*] delay treatment decision 6 months

[*E*] refer for consultation with other dental specialist(s)

[*F*] refer for second orthodontic opinion

[*G*] refer for consultation with psychologist

[ ] other (Please specify:________________________________)

G5. How much of a delay do you generally experience between final surgical consultation and actual date of surgery?

principal office	satellite office
[ ] 0 to 1 month	[ ] 0 to 1 month
[ ] 1 to 2 months	[ ] 1 to 2 months
[ ] 2 to 3 months	[ ] 2 to 3 months
[ ] 3 to 4 months	[ ] 3 to 4 months
[ ] 4 to 5 months	[ ] 4 to 5 months
[ ] 5 to 6 months	[ ] 5 to 6 months
[*7*] more than 6 months	[ ] more than 6 months
[*0*] N/A... surgery is booked at first surgical consult	[ ] N/A... surgery is booked at first surgical consult

ID#________

G6. How would you judge the technical expertise of the surgeons who are available to you for orthognathic referral?

[4] poor

[3] fair

[2] good

[1] excellent

G7. Do you refer orthognathic cases to a broad spectrum or a small group of oral surgeons based on your personal selection criteria?

principal office	satellite office
[1] broad spectrum	[ ] broad spectrum
[2] small group	[ ] small group

G8. How receptive to discussing treatment approach with you for particular patients (is/ are) the (surgeon/ surgeons) to whom you refer your orthognathic cases?

[1] very receptive

[2] receptive

[3] unreceptive

[4] very unreceptive

G9. To what degree (is/are) the (surgeon/surgeons) you refer orthognathic patients to willing to participate in advising the patient of the risks of orthognathic surgery?

[0] not at all

[3] to a minimal degree

[2] to a moderate degree

[1] in detail

G10. Which three factors of those listed below are most important to your selection of an oral surgeon for referral of orthognathic patients?

[A] fees

[B] practice location

[C] professional relationship to orthodontist

[D] rapport with patients

[E] technical expertise

THE FOLLOWING QUESTIONS EXAMINE PSYCHOLOGICAL SERVICES AVAILABLE TO ORTHODONTISTS

IF YOU HAVE A SATELLITE CLINIC, PLEASE RESPOND WHERE INDICATED. IF YOU DO NOT HAVE A SATELLITE CLINIC, PLEASE IGNORE QUESTIONS PERTAINING TO SATELLITES.

H1. How would you judge availability of psychologists who will counsel orthognathic patients in your practice area?

principal practice	satellite practice
[4] poor	[ ] poor
[3] fair	[ ] fair
[2] good	[ ] good
[1] excellent	[ ] excellent
[7] don't know	[ ] don't know

H2. Do you routinely refer patients for preorthodontic/ presurgical/ postsurgical psychological consultation?

[1] yes

[2] no

ID# ________

H3. How promptly (where prompt = 1 month) can an appointment be booked with psychologists in your practice area who counsel orthognathic patients?

principal practice	satellite clinic
[1] very promptly	[ ] very promptly
[2] promptly	[ ] promptly
[3] not promptly	[ ] not promptly
[7] don't know	[ ] don't know

H4. How would you judge the professional expertise of the psychologists who are available to you for counselling orthognathic patients?

[4] poor

[3] fair

[2] good

[1] excellent

[7] don't know

H5. How receptive to discussing treatment approach with you for particular patients (is/are) the (psychologist/ psychologists) to whom you refer your orthognathic patients?

[1] very receptive

[2] receptive

[3] unreceptive

[4] very unreceptive

[0] not applicable

H6. How important are psychologists' fees in your decision regarding whether you refer your orthognathic patients for psychological counselling?

[4] very unimportant

[3] unimportant

[2] important

[1] very important

[0] not applicable

H7. In the past year, what proportion of your orthognathic patients have you referred for psychological consultation regarding pre-surgical anxiety?

[1] all orthognathic patients

[2] more than half of orthognathic patients

[3] half of orthognathic patients

[4] less than half of orthognathic patients

[0] no orthognathic patient

H8. In the past year, what proportion of you orthognathic patients have you referred for psychological consultation regarding post-surgical depression?

[0] no orthognathic patient

[4] less than half of orthognathic patients

[3] half of orthognathic patients

[2] more than half of orthognathic patients

[1] all orthognathic patients

Please note that the request for results summary was detachable so that confidentiality could be maintained.

ID# ________

THE NEXT SECTION CLARIFIES FINAL DETAILS REGARDING YOUR PRACTICE EXPERIENCE

I1. Please record the year of your birth on the space provided below.

19____

I2. Please record the year of your completion of orthodontic graduate training on the space provided below.

19____

I3. Is the nature of your clinical practice presently:

(1) part-time

(2) full-time

(3) retired

I4. Is the nature of your orthodontic occupation presently: (Check off all that apply.)

(A) private practice

(B) academic

(C) institutional (Please specify nature:________________)

I5. Please indicate university degrees you have obtained by checking off all of the following that apply:

(A) undergraduate dental degree

(B) diploma/certificate in orthodontics

(C) masters degree (in orthodontic-related area)

(D) doctor of philosophy subsequent to accredited orthodontic training

I6. Please list the first three digits of the postal code at your:

principal office: ____________ A

satellite office: ____________ B

satellite office: ____________ C

satellite office: ____________ D

THANK YOU VERY MUCH FOR YOUR PARTICIPATION IN THIS STUDY, IT IS GREATLY APPRECIATED.

A STAMPED, ADDRESSED ENVELOPE IS ENCLOSED. PLEASE PLACE YOUR COMPLETED QUESTIONNAIRE IN THIS ENVELOPE AND SEAL THE ENVELOPE PRIOR TO MAILING.

TO RECEIVE A SUMMARY OF THE RESULTS OF THIS STUDY, PLEASE ENTER YOUR NAME AND ADDRESS ON THE ATTACHED SLIP (BELOW). YOUR QUESTIONNAIRE AND SUMMARY REQUEST WILL BE SEPARATED TO MAINTAIN YOUR CONFIDENTIALITY. THE SUMMARY WILL BE MAILED TO YOU NEXT YEAR OR IN THE EVENT OF CFAO SUPPORT OF THIS STUDY THE SUMMARY MAY BE INCLUDED IN A CAO NEWSLETTER.

Dear Nancy:

I would appreciate receiving a summary of the results of your study.

Please send results to:

____

____

____

____

Thank you.

APPENDIX V First Follow-up: Postcard

Dear

Recently a questionnaire was sent to you from the Division of Orthodontics at the University of Alberta.

If you have returned the questionnaire,
thank you for your participation in our study.

If you did not receive the questionnaire,
you can obtain one by calling (403-492-4469) or writing me.

If you haven't returned your questionnaire,
please don't forget. Your participation enhances the accuracy of our profile of the Canadian Orthodontist.

Nancy Weaver

Nancy Weaver, Graduate Student
c/o Division of Orthodontics
Faculty of Dentistry
University of Alberta
Edmonton, AB T6G 2N8

TO: ____________________________

____

____

____

APPENDIX VI Second Follow-up: Cover Letter

University of Alberta
Edmonton
Canada T6G 2N8

Faculty of Dentistry
Dentistry/Pharmacy Centre

CELEBRATING 75 Years and Forward 1917-1992

October 14, 1991

Fund for Dentistry
Investment in Excellence

title~ first name~ last name~
address~
city~, postal code~

Dear Dr. last name~:

This letter is sent to again request your response to the questionnaire you should have received about one month ago. The questionnaire was mailed out under the auspices of the Division of Orthodontics at the University of Alberta and fulfills part of my thesis requirement.

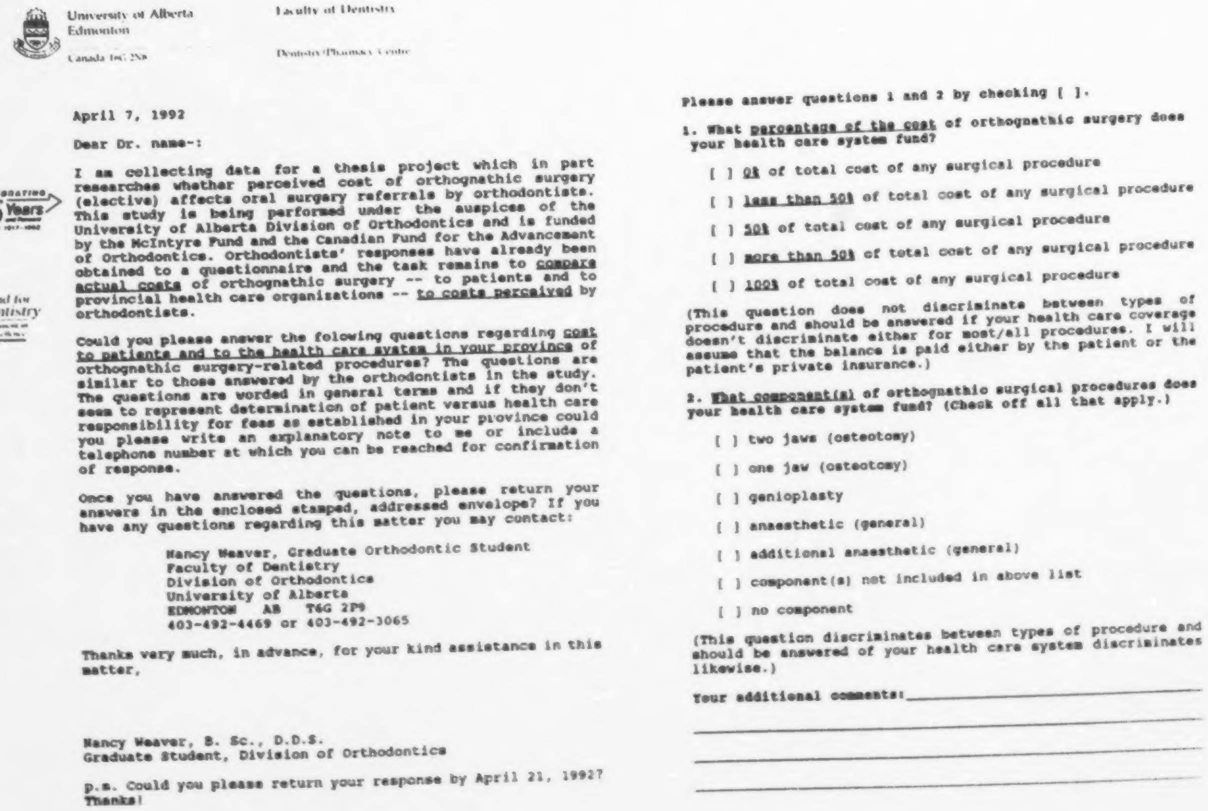
As you realize, your participation would increase the accuracy of what I consider to be an interesting and unique study whose purpose is to examine decision-making by the Canadian orthodontist.

In the event that the original questionnaire was misplaced, another has been enclosed today for your convenience.

Kindest regards,

Nancy Weaver, B. Sc., D.D.S.
Graduate Student, Division of Orthodontics
enclosure

APPENDIX VII Oral Surgeon Survey



University of Alberta
Edmonton
Canada T6G 2N8

Faculty of Dentistry

Dentistry/Pharmacy Centre

April 7, 1992

Dear Dr. name-:

I am collecting data for a thesis project which in part researches whether perceived cost of orthognathic surgery (elective) affects oral surgery referrals by orthodontists. This study is being performed under the auspices of the University of Alberta Division of Orthodontics and is funded by the McIntyre Fund and the Canadian Fund for the Advancement of Orthodontics. Orthodontists' responses have already been obtained to a questionnaire and the task remains to compare actual costs of orthognathic surgery -- to patients and to provincial health care organizations -- to costs perceived by orthodontists.

Could you please answer the folowing questions regarding cost to patients and to the health care system in your province of orthognathic surgery-related procedures? The questions are similar to those answered by the orthodontists in the study. The questions are worded in general terms and if they don't seem to represent determination of patient versus health care responsibility for fees as established in your province could you please write an explanatory note to me or include a telephone number at which you can be reached for confirmation of response.

Once you have answered the questions, please return your answers in the enclosed stamped, addressed envelope? If you have any questions regarding this matter you may contact:

Nancy Weaver, Graduate Orthodontic Student
Faculty of Dentistry
Division of Orthodontics
University of Alberta
EDMONTON AB T6G 2P9
403-492-4469 or 403-492-3065

Thanks very much, in advance, for your kind assistance in this matter,

Nancy Weaver, B. Sc., D.D.S.
Graduate Student, Division of Orthodontics

p.s. Could you please return your response by April 21, 1992?
Thanks!

Please answer questions 1 and 2 by checking [ ].

1. What percentage of the cost of orthognathic surgery does your health care system fund?

[ ] 0% of total cost of any surgical procedure

[ ] less than 50% of total cost of any surgical procedure

[ ] 50% of total cost of any surgical procedure

[ ] more than 50% of total cost of any surgical procedure

[ ] 100% of total cost of any surgical procedure

(This question does not discriminate between types of procedure and should be answered if your health care coverage doesn't discriminate either for most/all procedures. I will assume that the balance is paid either by the patient or the patient's private insurance.)

2. What component(s) of orthognathic surgical procedures does your health care system fund? (Check off all that apply.)

[ ] two jaws (osteotomy)

[ ] one jaw (osteotomy)

[ ] genioplasty

[ ] anaesthetic (general)

[ ] additional anaesthetic (general)

[ ] component(s) not included in above list

[ ] no component

(This question discriminates between types of procedure and should be answered of your health care system discriminates likewise.)

Your additional comments:____________________

APPENDIX VIII Recommendations for Minor Treatment Options

Figure 1.
Recommendation: Delay Decision

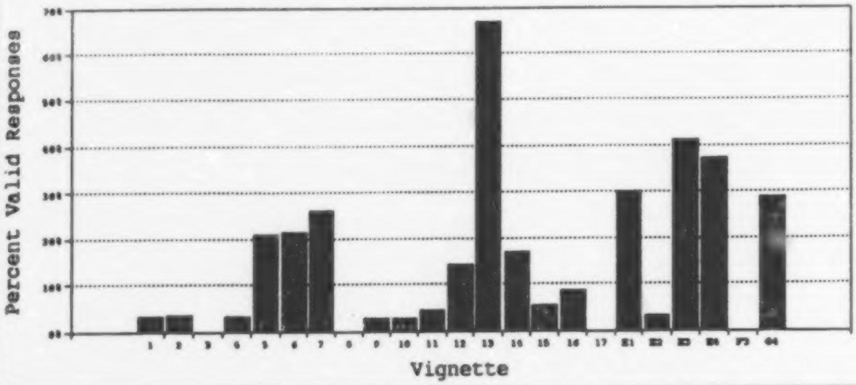


Figure 2.
Recommendation: Second Orthodontist

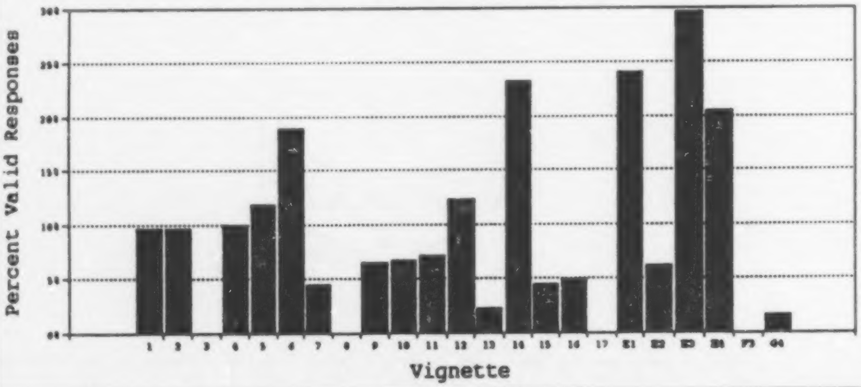
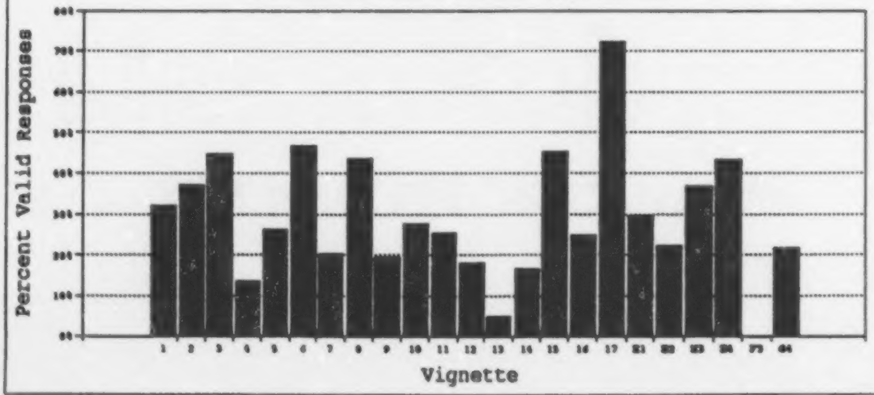


Figure 3.
Recommendation: Dental Specialist



APPENDIX IX Significant ANOVA Summaries

Table 1. H1 Summary: Vignette (V) by Treatment Option (T) by Graduation Year (GY)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	2584.01	414.85	2584.01	1.48	1744.06	1.0	280.0	0.0*
GY	26.90	414.85	6.73	1.48	4.54	4.0	280.0	0.00144
!V	Σ	0.76	1.90	0.11	17.77	13.7	5529.0	0.874E-6*
!GY·V	Σ	0.76	0.16	0.11	1.51	55.0	5529.0	0.00889
!T	Σ	0.76	196.37	0.68	288.77	4.6	1897.0	0.00006*
!GY·T	**Σ**	**0.76**	**2.27**	**0.68**	**3.34***	**18.3**	**1897.0**	**0.472E-5***
!V·T	Σ	0.47	6.61	0.10	63.43	50.3	32956.0	0.00026*
!GY·V·T	**Σ**	**0.47**	**0.17**	**0.10**	**1.61***	**201.3**	**32956.0**	**0.00009***
c	*414.85	3432.92	1.48	0.10	14.22	280.0	32956.0	0.00028*
V·c	*591.51	3432.92	0.11	0.10	1.03	5529.0	32956.0	0.09571
T·c	*1289.99	3432.92	0.68	0.10	6.53	1897.0	32956.0	0.00058*
V·T·c	*3432.92	****	0.10	****	****	32596.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or *P < .001.

Table 2. H4 Summary: Vignette (V) by Treatment Option (T) by Perception of Justification for Cost of Surgery in Case of Moderately Compromised Function (B3B)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	3219.16	390.93	3219.16	1.40	2305.69	1.0	280.0	0.0*
B3B	47.63	390.93	47.63	1.40	34.11	1.0	280.0	0.143E-7*
!V	Σ	0.76	2.71	0.11	25.42	13.7	4213.1	0.354E-6*
!B3B·V	**Σ**	**0.76**	**0.36**	**0.11**	**3.39**	**13.7**	**4213.1**	**0.00003***
!T	Σ	0.78	242.22	0.67	362.18	4.7	1469.3	0.0*
!B3B·T	**Σ**	**0.78**	**10.99**	**0.67**	**16.44**	**4.7**	**1469.3**	**0.630E-11***
!V·T	Σ	0.47	8.13	0.10	77.77	50.4	15373.8	0.00034*
!B3B·V·T	**Σ**	**0.47**	**0.31**	**0.10**	**2.97**	**50.4**	**15373.8**	**0.00007***
c	*390.93	3442.07	1.40	0.10	13.36	280.0	32933.0	0.00028*
V·c	*589.35	3442.07	0.11	0.10	1.02	5524.0	32933.0	0.15692
T·c	*1263.99	3442.07	0.67	0.10	6.40	1890.0	32933.0	0.00058*
V·T·c	*3442.07	****	0.10	****	****	32933.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or *P < .001.

Table 3. H4 Summary: Vignette (V) by Treatment Option (T) by Perception of Justification for Cost of Surgery in Case of Mildly Compromised Function (B3C)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	1554.08	428.30	1554.08	1.53	1015.97	1.0	280.0	0.0*
B3C	5.35	428.30	5.35	1.53	3.50	1.0	280.0	0.06259
!V	Σ	0.76	1.47	0.11	13.71	13.7	4192.7	0.130E-5*
!B3C·V	Σ	0.76	0.13	0.11	1.20	13.7	4192.7	0.26553
!T	Σ	0.76	117.83	0.69	170.16	4.5	1430.2	0.00004*
!B3C·T	Σ	0.76	3.60	0.69	5.20	4.5	1430.2	0.00018*
!V·T	Σ	0.46	3.87	0.11	36.87	50.0	15248.1	0.00015*
!B3C·V·T	Σ	0.46	0.14	0.11	1.30	50.0	15248.1	0.07819
c	*428.30	3460.78	1.53	0.11	14.56	280.0	32933.0	0.00028*
V·c	*593.74	3460.78	0.11	0.11	1.02	5524.0	32933.0	0.13468
T·c	*1308.76	3460.78	0.69	0.11	6.59	1890.0	32933.0	0.00058*
V·T·c	*3460.78	****	0.11	****	****	32933.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or *P < .001.

Table 4. H4 Summary: Vignette (V) by Treatment Option (T) by Perception of Justification for Cost of Surgery in Case of Moderately Compromised Esthetics (B3E)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	3332.64	401.45	3332.64	1.43	2324.40	1.0	280.0	0.0*
B3E	36.87	401.45	36.87	1.43	25.71	1.0	280.0	0.721E-6*
!V	Σ	0.76	2.99	0.11	28.01	13.7	4210.6	0.790E-7*
!B3E·V	Σ	0.76	0.36	0.11	3.42	13.7	4210.6	0.00003*
!T	Σ	0.77	250.81	0.68	369.40	4.6	1454.7	0.0*
!B3E·T	Σ	0.77	7.80	0.68	11.49	4.6	1454.7	0.320E-9*
!V·T	Σ	0.47	8.10	0.10	77.41	50.3	15351.6	0.00030*
!B3E·V·T	Σ	0.47	0.27	0.10	2.59	50.3	15351.6	0.00008*
c	*401.45	3446.26	1.43	0.10	13.70	280.0	32933.0	0.00028*
V·c	*589.23	3446.26	0.11	0.10	1.02	5524.0	32933.0	0.17410
T·c	*1283.28	3446.26	0.68	C.10	6.49	1890.0	32933.0	0.00058*
V·T·c	*3446.26	****	0.10	****	****	32933.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or *P < .001.

Table 5. Summary: H5 Vignette (V) by Treatment Option (T) by Willingness to Switch to Camouflage for Anxious Surgical Patient (F3B)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	3104.21	418.28	3104.21	1.49	2077.97	1.0	280.0	0.0*
F3B	23.49	418.28	23.49	1.49	15.72	1.0	280.0	0.00009*
!V	Σ	0.76	2.64	0.11	24.61	13.7	4170.1	0.145E-6*
!F3B·V	Σ	0.76	0.16	0.11	1.47	13.7	4170.1	0.11482
!T	Σ	0.76	227.66	0.69	327.69	4.5	1405.1	0.0*
!F3B·T	Σ	0.76	4.45	0.69	6.40	4.5	1405.1	0.00002*
!V·T	Σ	0.46	8.03	0.11	76.26	50.2	15150.4	0.00030*
!F3B·V·T	Σ	0.46	0.14	0.11	1.32	50.2	15150.4	0.06337
c	*418.28	3431.83	1.49	0.11	14.19	280.0	32602.0	0.00028*
V·c	*586.18	3431.83	0.11	0.11	1.02	5463.0	32602.0	0.17539
T·c	*1288.76	3431.83	0.69	0.11	6.60	1855.0	32602.0	0.00058*
V·T·c	*3431.83	****	0.11	****	****	32602.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or *$P < .001$.

Table 6. H5 Summary: Vignette (V) by Treatment Option (T) by Trying to Convince Anxious Surgical Patient to Follow Through with Surgery (F30)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	3257.79	431.11	3257.79	1.54	2115.89	1.0	280.0	0.0*
F30	8.16	431.11	8.16	1.54	5.30	1.0	280.0	0.02203
!V	Σ	0.77	2.90	0.11	27.00	13.8	4179.3	0.117E-6*
!F30·V	Σ	0.77	0.15	0.11	1.40	13.8	4179.3	0.14484
!T	Σ	0.76	244.27	0.69	352.66	4.6	1418.3	0.0*
!F30·T	Σ	0.76	5.09	0.69	7.34	4.6	1418.3	0.205E-5*
!V·T	Σ	0.46	8.09	0.11	76.78	50.1	15120.5	0.00030*
!F30·V·T	Σ	0.46	0.11	0.11	1.04	50.1	15120.5	0.38729
c	*431.11	3435.03	1.54	0.11	14.61	280.0	32602.0	0.00028*
V·c	*586.16	3435.03	0.11	0.11	1.02	5463.0	32602.0	0.18780
T·c	*1284.90	3435.03	0.69	0.11	6.57	1855.0	32602.0	0.00058*
V·T·c	*3435.03	****	0.11	****	****	32602.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or *$P < .001$.

Table 7. H7 Summary: Vignette (V) by Treatment Option (T) by Total Psychological Referral (Group)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	3371.44	490.44	3371.44	1.76	1917.94	1.0	279.0	0.0*
G	9.93	490.44	4.97	1.76	2.83	2.0	279.0	0.06098
!V	Σ	0.73	5.86	0.16	36.40	13.9	3890.5	0.00004*
!G·V	Σ	0.73	0.12	0.16	0.78	27.9	3890.5	0.79360
!T	Σ	0.97	192.21	0.81	238.42	1.9	540.6	0.109E-6*
!G·T	Σ	**0.97**	**3.87**	**0.81**	**4.80**	**3.9**	**540.6**	**0.00094***
!V·T	Σ	0.68	11.12	0.13	87.34	25.9	7225.5	0.00019*
!G·V·T	Σ	0.68	0.20	0.13	1.60	51.8	7225.5	0.00396
c	*490.49	1350.03	1.76	0.13	13.80	279.0	10602.0	0.00023*
V·c	*852.63	1350.03	0.16	0.13	1.26	5301.0	10602.0	0.00002*
T·c	*449.83	1350.03	0.81	0.13	6.33	558.0	10602.0	0.00016*
V·T·c	*1350.03	****	0.13	****	****	10602.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or **P* < .001.

APPENDIX X Hypothesis 1 Least-Squared Means

Table 1. ANOVA: LSQ-MEAN Graduation Year, Treatment Option

Treatment Option	Year of Graduation from Orthodontic Program				
	1950-1961	1962-1971	1972-1981	1982-1986	1987-1991
no treatment	0.194	0.217	0.253	0.218	0.276
delay decision	0.200	0.169	0.180	0.157	0.214
dental specialist	0.151	0.199	0.300	0.318	0.297
second opinion	0.121	0.110	0.125	0.099	0.094
psychologist	0.043	0.067	0.075	0.055	0.053

Table 2. ANOVA, LSQ-MEAN Graduation Year, Treatment Option, Vignette: Surgery

Vignette	Graduation Year				
	1950-1961	1962-1971	1972-1981	1982-1986	1987-1991
developmental defect	0.759	0.855	0.912	0.873	0.851
traumatic defect	0.786	0.839	0.851	0.762	0.804
excellent esthetics	0.200	0.246	0.281	0.381	0.370
negative life	0.448	0.435	0.570	0.683	0.565
not listen	0.167	0.328	0.513	0.476	0.400
poor health	0.0	0.097	0.088	0.177	0.133
extrovert	0.207	0.393	0.545	0.810	0.667
self-image	0.621	0.726	0.841	0.921	0.822
introvert	0.345	0.500	0.702	0.774	0.773
intolerant	0.207	0.344	0.487	0.590	0.477
uncooperative	0.0	0.048	0.026	0.033	0.0
time/ cost	0.138	0.306	0.421	0.516	0.409
fears GA	0.138	0.258	0.526	0.645	0.682
self-esteem	0.407	0.590	0.737	0.855	0.837
no support	0.207	0.323	0.456	0.556	0.500
resemblance	0.241	0.371	0.619	0.825	0.659
minor, dispute	0.138	0.339	0.451	0.508	0.477
spousal pressure	0.276	0.452	0.495	0.413	0.381
impatient	0.407	0.532	0.637	0.540	0.750

Table 3. ANOVA, LSQ-MEAN Graduation Year, Treatment Option, Vignette: Camouflage

Vignette	Graduation Year				
	1950-1961	1962-1971	1972-1981	1982-1986	1987-1991
developmental defect	0.345	0.403	0.469	0.429	0.617
traumatic defect	0.250	0.435	0.491	0.444	0.565
excellent esthetics	0.633	0.852	0.851	0.841	0.848
negative life	0.310	0.677	0.412	0.444	0.543
not listen	0.367	0.656	0.558	0.524	0.556
poor health	0.600	0.726	0.664	0.839	0.689
extrovert	0.759	0.918	0.893	0.873	0.933
self-image	0.517	0.597	0.628	0.698	0.756
introvert	0.655	0.887	0.868	0.887	0.886
intolerant	0.483	0.541	0.549	0.607	0.636
uncooperative	0.172	0.081	0.053	0.050	0.0
time/ cost	0.621	0.758	0.702	0.645	0.636
fears GA	0.828	0.855	0.781	0.855	0.909
self-esteem	0.667	0.787	0.737	0.758	0.814
no support	0.483	0.694	0.596	0.651	0.591
resemblance	0.655	0.887	0.903	0.905	0.932
minor, dispute	0.414	0.758	0.522	0.508	0.545
spousal pressure	0.586	0.581	0.459	0.492	0.381
impatient	0.481	0.565	0.522	0.476	0.625

Table 4. ANOVA, LSQ-MEAN Graduation Year, Treatment Option, Vignette: No Treatment

Vignette	Graduation Year				
	1950-1961	1962-1971	1972-1981	1982-1986	1987-1991
developmental defect	0.0	0.081	0.062	0.095	0.149
traumatic defect	0.036	0.065	0.061	0.095	0.109
excellent esthetics	0.200	0.131	0.149	0.111	0.196
negative life	0.034	0.145	0.167	0.159	0.196
not listen	0.067	0.197	0.204	0.190	0.244
poor health	0.267	0.339	0.434	0.355	0.378
extrovert	0.207	0.230	0.205	0.190	0.178
self-image	0.172	0.145	0.142	0.175	0.200
introvert	0.138	0.145	0.184	0.194	0.159
intolerant	0.517	0.443	0.558	0.459	0.545
uncooperative	0.586	0.629	0.491	0.483	0.636
time/ cost	0.345	0.306	0.465	0.339	0.500
fears GA	0.034	0.161	0.228	0.194	0.273
self-esteem	0.111	0.131	0.272	0.129	0.233
no support	0.276	0.371	0.377	0.254	0.409
resemblance	0.310	0.161	0.230	0.143	0.205
minor, dispute	0.207	0.274	0.292	0.302	0.341
spousal pressure	0.172	0.113	0.180	0.159	0.167
impatient	0.0	0.048	0.115	0.111	0.125

Table 5. ANOVA, LSQ-MEAN Graduation Year, Treatment Option, Vignette: Delay Decision

Vignette	Graduation Year				
	1950-1961	1962-1971	1972-1981	1982-1986	1987-1991
developmental defect	0.034	0.016	0.027	0.016	0.085
traumatic defect	0.036	0.016	0.018	0.032	0.109
excellent esthetics	0.200	0.033	0.035	0.0	0.043
negative life	0.207	0.161	0.219	0.175	0.304
not listen	0.267	0.180	0.230	0.143	0.289
poor health	0.200	0.323	0.310	0.145	0.267
extrovert	0.034	0.033	0.018	0.032	0.044
self-image	0.069	0.032	0.035	0.016	0.0
introvert	0.103	0.065	0.018	0.016	0.091
intolerant	0.172	0.180	0.142	0.131	0.091
uncooperative	0.655	0.645	0.658	0.667	0.750
time/ cost	0.310	0.129	0.175	0.065	0.273
fears GA	0.034	0.113	0.061	0.016	0.023
self-esteem	0.074	0.098	0.088	0.065	0.093
no support	0.345	0.290	0.263	0.333	0.341
resemblance	0.069	0.032	0.027	0.016	0.045
minor, dispute	0.414	0.403	0.425	0.397	0.409
spousal pressure	0.448	0.258	0.378	0.365	0.476
impatient	0.259	0.210	0.292	0.349	0.325

Table 6. ANOVA, LSQ-MEAN Graduation Year, Treatment Option, Vignette: Refer to Other Dental Specialist

Vignette	Graduation Year				
	1950-1961	1962-1971	1972-1981	1982-1986	1987-1991
developmental defect	0.310	0.323	0.372	0.286	0.255
traumatic defect	0.357	0.323	0.395	0.413	0.326
excellent esthetics	0.067	0.098	0.184	0.143	0.109
negative life	0.241	0.194	0.254	0.317	0.304
not listen	0.267	0.344	0.513	0.587	0.489
poor health	0.133	0.145	0.221	0.177	0.311
extrovert	0.034	0.148	0.205	0.270	0.222
self-image	0.069	0.226	0.319	0.349	0.289
introvert	0.069	0.145	0.298	0.355	0.273
intolerant	0.034	0.131	0.221	0.197	0.205
uncooperative	0.069	0.065	0.044	0.067	0.0
time/ cost	0.069	0.129	0.158	0.258	0.182
fears GA	0.310	0.194	0.561	0.484	0.591
self-esteem	0.037	0.180	0.307	0.290	0.256
no support	0.172	0.194	0.342	0.333	0.341
resemblance	0.069	0.113	0.248	0.270	0.341
minor, dispute	0.172	0.258	0.381	0.460	0.477
spousal pressure	0.172	0.371	0.468	0.492	0.524
impatient	0.222	0.194	0.212	0.286	0.150

Table 7. ANOVA, LSQ-MEAN Graduation Year, Treatment Option, Vignette: Refer to Another Orthodontist

Vignette	Graduation Year				
	1950-1961	1962-1971	1972-1981	1982-1986	1987-1991
developmental defect	0.138	0.065	0.106	0.095	0.085
traumatic defect	0.143	0.081	0.070	0.127	0.087
excellent esthetics	0.067	0.066	0.088	0.143	0.130
negative life	0.207	0.097	0.140	0.063	0.111
not listen	0.333	0.131	0.212	0.159	0.156
poor health	0.067	0.065	0.044	0.048	0.0
extrovert	0.069	0.098	0.062	0.048	0.044
self-image	0.034	0.097	0.088	0.032	0.044
introvert	0.034	0.065	0.088	0.048	0.091
intolerant	0.138	0.131	0.150	0.082	0.091
uncooperative	0.069	0.048	0.009	0.017	0.0
time/ cost	0.276	0.177	0.237	0.226	0.273
fears GA	0.034	0.048	0.061	0.016	0.045
self-esteem	0.074	0.049	0.079	0.0	0.023
no support	0.276	0.226	0.298	0.206	0.136
resemblance	0.034	0.048	0.071	0.063	0.068
minor, dispute	0.172	0.306	0.345	0.302	0.227
spousal pressure	0.138	0.258	0.225	0.206	0.119
impatient	0.0	0.032	0.009	0.0	0.050

Table 8. ANOVA, LSQ-MEAN Graduation Year, Treatment Option, Vignette: Refer to Psychologist

Vignette	Graduation Year				
	1950-1961	1962-1971	1972-1981	1982-1986	1987-1991
developmental defect	0.069	0.048	0.044	0.032	0.021
traumatic defect	0.036	0.032	0.026	0.032	0.0
excellent esthetics	0.0	0.0	0.0	0.0	0.0
negative life	0.207	0.355	0.518	0.508	0.370
not listen	0.0	0.033	0.062	0.048	0.044
poor health	0.0	0.0	0.009	0.0	0.0
extrovert	0.0	0.016	0.009	0.016	0.044
self-image	0.0	0.065	0.071	0.0	0.022
introvert	0.069	0.081	0.079	0.065	0.068
intolerant	0.0	0.049	0.035	0.016	0.023
uncooperative	0.034	0.081	0.0	0.0	0.023
time/ cost	0.0	0.016	0.0	0.0	0.0
fears GA	0.069	0.048	0.026	0.032	0.023
self-esteem	0.259	0.262	0.316	0.258	0.140
no support	0.069	0.065	0.035	0.0	0.068
resemblance	0.0	0.0	0.0	0.0	0.023
minor, dispute	0.0	0.048	0.071	0.0	0.023
spousal pressure	0.0	0.065	0.126	0.032	0.095
impatient	0.0	0.016	0.0	0.0	0.025

APPENDIX XI Hypothesis 2 ANOVA Summaries

Table 1. Summary: Vignette (V) by Treatment Option (T) by Oral Surgeon Availability (CSD)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	2008.02	327.14	2008.02	1.43	1399.50	1.0	228.0	**0.0***
CSD	35.48	327.14	5.91	1.43	4.12	6.0	228.0	**0.00060***
!V	Σ	0.74	1.78	0.10	17.02	13.3	3328.4	**0.418E-6***
!CSD·V	Σ	0.74	0.12	0.10	1.19	79.8	3328.4	0.12672
!T	Σ	0.75	155.49	0.70	222.04	4.5	1167.6	**0.00003***
!CSD·T	Σ	0.75	1.31	0.70	1.87	27.1	1167.6	0.00442
!V·T	Σ	0.44	4.82	0.10	46.32	47.9	11908.8	**0.00019***
!CSD·V·T	Σ	0.44	0.12	0.10	1.15	287.3	11908.8	0.04772
c	*327.14	2791.95	1.43	0.10	13.80	228.0	26860.0	**0.00024***
V·c	*470.05	2791.95	0.10	0.10	1.00	4507.0	26860.0	0.43943
T·c	*1085.41	2791.95	0.70	0.10	6.74	1550.0	26860.0	**0.00050***
V·T·c	*2791.95	****	0.10	****	****	26860.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or **P* < .001; CSD = calculated oral surgeon: population of Census Subdivision for respondent practice area, grouped data

Table 2. Summary: Vignette (V) by Treatment Option (T) by Oral Surgeon Availability (CMA)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	503.67	109.47	503.67	1.32	**381.89**	1.0	83.0	**0.849E-32***
CMA	15.22	109.47	1.69	1.32	1.28	9.0	83.0	0.25898
!V	Σ	0.67	0.61	0.11	**5.68**	12.0	1132.5	**0.326E-6***
!CMA·V	Σ	0.67	0.15	0.11	1.39	107.8	1132.5	0.00665
!T	Σ	0.73	44.16	0.72	**61.54**	4.4	426.0	**0.196E-7***
!CMA·T	Σ	0.73	0.68	0.72	0.95	39.5	426.0	0.55967
!V·T	Σ	0.32	1.40	0.10	**13.69**	34.2	3204.3	**0.182E-5***
!CMA·V·T	Σ	0.32	0.11	0.10	1.06	307.6	3204.3	0.23689
c	*109.47	1038.79	1.32	0.10	**12.86**	83.0	10127.0	**0.00008***
V·c	*182.47	1038.79	0.11	0.10	1.05	1702.0	10127.0	0.11368
T·c	*417.67	1038.79	0.72	0.10	**7.00**	582.0	10127.0	**0.00019***
V·T·c	*1038.79	****	0.10	****	****	10127.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or **P* < .001; CMA = calculated oral surgeon: population of applicable CSD, CA, or CMA for respondent practice area, grouped data

Table 3. Summary: Vignette (V) by Treatment Option (T) by Orthodontists' Subjective Estimate of Oral Surgeon Availability (G1P)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	1308.28	410.46	1308.28	1.54	**851.02**	1.0	267.0	**0.0***
G1P	19.01	410.46	6.34	1.54	4.12	3.0	267.0	0.00701
!V	Σ	0.76	1.32	0.11	**12.50**	13.7	3956.6	**0.102E-5***
!G1P·V	Σ	0.76	0.16	0.11	1.49	41.0	3956.6	0.02420
!T	Σ	0.76	100.95	0.72	**240.98**	4.6	1344.6	**0.00004***
!G1P·T	Σ	0.76	0.89	0.72	1.25	13.7	1344.6	0.23664
!V·T	Σ	0.46	2.98	0.10	**28.42**	49.4	14299.6	**0.00012***
!G1P·V·T	Σ	0.46	0.12	0.10	1.12	148.2	14299.6	0.15056
c	*410.46	3259.24	1.54	0.10	**14.67**	267.0	31109.0	**0.00028***
V·c	*550.98	3259.24	0.11	0.10	1.01	5213.0	31109.0	0.33688
T·c	*1267.37	3259.24	0.72	0.10	**6.83**	1770.0	31109.0	**0.00058***
V·T·c	*3259.24	****	0.10	****	****	31109.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or *P* < .001.

Table 4. Summary: Vignette (V) by Treatment Option (T) by Delay to Initial Surgical Consult (G3P)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	211.07	393.15	211.07	1.47	**143.35**	1.0	267.0	**0.123E-6***
G3P	34.88	393.15	5.81	1.47	**3.95**	6.0	267.0	**0.00084***
!V	Σ	0.76	0.20	0.11	1.84	13.6	3933.0	0.02979
!G3P·V	Σ	0.76	0.09	0.11	0.85	81.7	3933.0	0.82387
!T	Σ	0.75	15.92	0.71	**22.54**	4.5	1330.2	**0.351E-11***
!G3P·T	Σ	0.75	0.76	0.71	1.07	27.2	1330.2	0.36780
!V·T	Σ	0.46	0.65	0.10	**6.21**	49.8	14315.6	**0.00003***
!G3P·V·T	Σ	0.46	0.11	0.10	1.04	299.0	14315.6	0.30305
c	*393.15	3253.73	1.47	0.10	**14.04**	267.0	31026.0	**0.00028***
V·c	*557.07	3253.73	0.11	0.10	1.02	5198.0	31026.0	0.15130
T·c	*1245.04	3253.73	0.71	0.10	**6.73**	1763.0	31026.0	**0.00058***
V·T·c	-3253.73	****	0.10	****	****	31026.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or *P* < .001.

Table 5. Summary: Vignette (V) by Treatment Option (T) by Delay, Final Surgical Consult to Surgery (G5P)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	2005.09	348.99	2005.09	1.53	**1309.94**	1.0	228.0	**0.0***
G5P	10.53	348.99	1.75	1.53	1.15	6.0	228.0	0.33644
V	Σ	0.76	2.02	0.10	**19.32**	13.6	3365.5	**0.386E-6***
G5P·V	Σ	0.76	0.11	0.10	1.07	81.6	3365.5	0.32364
T	Σ	0.77	154.27	0.71	**217.82**	4.6	1165.5	**0.00003***
G5P·T	Σ	0.77	0.88	0.71	1.25	27.7	1165.5	0.17644
V·T	Σ	0.44	5.05	0.10	**48.17**	48.0	11808.3	**0.00019***
G5P·V·T	Σ	0.44	0.11	0.10	1.02	287.7	11808.3	0.41617
c	*348.99	2788.00	1.53	0.10	**14.60**	228.0	26594.0	**0.00024***
V·c	*465.68	2788.00	0.10	0.10	1.00	4457.0	26594.0	0.55655
T·c	*1072.98	2788.00	0.71	0.10	**6.76**	1515.0	26594.0	**0.00050***
V·T·c	*2788.00	****	0.10	****	****	26594.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or *P* < .001.

APPENDIX XII Hypothesis 3 ANOVA Summaries

Table 1. Summary: Vignette (V) by Treatment Option (T) by Perception of Cost of Surgery as Financial Burden to Patient (B1)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	1280.51	342.12	1280.51	1.49	**857.12**	1.0	229.0	**0.0***
B1	14.56	342.12	3.64	1.49	2.44	4.0	229.0	0.04803
!V	Σ	0.75	1.59	0.11	**14.96**	13.5	3409.9	**0.312E-6***
!B1·V	Σ	0.75	0.16	0.11	1.53	54.1	3409.9	0.00817
!T	Σ	0.74	87.23	0.73	**120.18**	4.4	1155.5	**0.00004***
!B1·T	Σ	0.74	0.55	0.73	0.76	17.7	1155.5	0.75117
!V·T	Σ	0.44	3.03	0.10	**29.37**	47.4	11864.1	**0.00011***
!B1·V·T	Σ	0.44	0.10	0.10	0.97	189.5	11864.1	0.58756
c	*342.12	2789.73	1.49	0.10	**14.49**	229.0	27050.0	**0.00024***
V·c	*482.94	2789.73	0.11	0.10	1.03	4540.0	27050.0	0.08467
T·c	*1134.49	2789.73	0.73	0.10	**7.04**	1563.0	27050.0	**0.00054***
V·T·c	*2789.73	****	0.10	****	****	27050.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or *P* < .001.

Table 2. Summary: Vignette (V) by Treatment Option (T) by Perception of Cost of Surgery as Financial Burden to Provincial Health Care System (B2)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	461.414	315.65	461.14	1.45	**317.03**	1.0	217.0	**0.257E-43***
B2	16.56	315.65	4.14	1.45	2.85	4.0	217.0	0.02498
!V	Σ	0.76	0.57	0.11	**4.99**	13.6	3196.5	**0.307E-5***
!B2·V	Σ	0.76	0.14	0.11	1.23	54.4	3196.5	0.12148
!T	Σ	0.75	35.99	0.72	**49.71**	4.5	1085.8	**0.372E-9***
!B2·T	Σ	0.75	0.85	0.72	1.18	18.1	1085.8	0.26903
!V·T	Σ	0.44	1.00	0.10	**9.63**	47.0	10973.8	**0.00001***
!B2·V·T	Σ	0.44	0.11	0.10	1.02	187.9	10973.8	0.41059
c	*315.65	2624.66	1.45	0.10	**13.98**	217.0	25227.0	**0.00020***
V·c	*478.96	2624.66	0.11	0.10	**1.09**	4228.0	25227.0	**0.00019***
T·c	*1044.00	2624.66	0.72	0.10	**6.96**	1442.0	25227.0	**0.00046***
V·T·c	*2624.66	****	0.10	****	****	25227.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or **P* < .001.

APPENDIX XIII Hypothesis 4 ANOVA Summaries and LSQ-Means

Table 1. Summary: Vignette (V) by Treatment Option (T) by Perception of Cost of Surgery as Justified in Case of Severely Compromised Function (B3A)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	1885.47	428.23	1885.47	1.53	**1232.83**	1.0	280.0	**0.0•**
B3A	0.12	428.23	0.12	1.53	0.08	1.0	280.0	0.77671
!V	Σ	0.76	1.64	0.11	**15.26**	13.7	4199.7	**0.941E-6•**
!B3A•V	Σ	0.76	0.09	0.11	0.81	13.7	4199.7	0.65712
!T	Σ	0.76	153.59	0.70	**219.04**	4.6	1433.5	**0.00007•**
!B3A•T	Σ	0.76	0.82	0.70	1.17	4.6	1433.5	0.32298
!V•T	Σ	0.46	4.61	0.11	**43.79**	49.9	15227.3	**0.00019•**
!B3A•V•T	Σ	0.46	0.09	0.11	0.86	49.9	15227.3	0.74794
c	*428.23	3465.53	1.53	0.11	**14.53**	280.0	32933.0	**0.00028•**
V•c	*594.08	3465.53	0.11	0.11	1.02	5524.0	32933.0	0.14328
T•c	*1325.26	3465.53	0.70	0.11	**6.66**	1890.0	32933.0	**0.00061•**
V•T•c	*3465.53	****	0.11	****	****	32933.0	****	****

Note. • = interaction; * = use of residual where appropriate error term could not be found or *P < .001.

Table 2. ANOVA, LSQ-MEAN V•B3B

Vignette	B3B	
	Not Chosen	Chosen
developmental defect	0.248	0.291
traumatic defect	0.241	0.290
excellent esthetics	0.198	0.239
negative life	0.274	0.349
not listen	0.255	0.334
poor health	0.215	0.269
extrovert	0.240	0.311
self-image	0.258	0.318
introvert	0.260	0.340
intolerant	0.237	0.326
uncooperative	0.201	0.199
time/ cost	0.262	0.316
fears GA	0.245	0.345
self-esteem	0.279	0.376
no support	0.278	0.366
resemblance	0.225	0.333
minor, dispute	0.294	0.379
spousal pressure	0.279	0.335
impatient	0.211	0.281

Note. V=vignette; B3B=perception of justification for cost of surgery in moderately compromised function

Table 3. ANOVA, LSQ-MEAN V•T•B3B

Vignette	B3B, Surgery		B3B, Camouflage	
	Not Chosen	Chosen	Not Chosen	Chosen
developmental defect	0.833	0.898	0.417	0.491
traumatic defect	0.768	0.857	0.394	0.512
excellent esthetics	0.232	0.357	0.796	0.851
negative life	0.451	0.631	0.465	0.494
not listen	0.254	0.560	0.535	0.566
poor health	0.056	0.152	0.741	0.685
extrovert	0.386	0.689	0.857	0.916
self-image	0.755	0.855	0.587	0.693
introvert	0.497	0.788	0.853	0.867
intolerant	0.329	0.552	0.479	0.636
uncooperative	0.028	0.024	0.092	0.037
time/ cost	0.259	0.497	0.643	0.721
fears GA	0.287	0.648	0.832	0.836
self-esteem	0.557	0.848	0.671	0.835
no support	0.287	0.554	0.552	0.669
resemblance	0.345	0.783	0.845	0.916
minor, dispute	0.282	0.524	0.493	0.614
spousal pressure	0.314	0.530	0.436	0.537
impatient	0.511	0.659	0.496	0.567

Note. V=vignette; T=treatment option; B3B=perception of justification for cost of surgery in case of moderately compromised function

Table 4. ANOVA, LSQ-MEAN V•T•B3B

Vignette	B3B, No Treatment		B3B, Delay Decision	
	Not Chosen	Chosen	Not Chosen	Chosen
developmental defect	0.056	0.102	0.021	0.042
traumatic defect	0.042	0.101	0.035	0.036
excellent esthetics	0.113	0.179	0.035	0.030
negative life	0.127	0.179	0.183	0.238
not listen	0.169	0.217	0.239	0.193
poor health	0.329	0.418	0.189	0.333
extrovert	0.164	0.240	0.029	0.030
self-image	0.133	0.187	0.035	0.024
introvert	0.133	0.206	0.049	0.036
intolerant	0.450	0.558	0.157	0.127
uncooperative	0.549	0.549	0.641	0.695
time/ cost	0.392	0.406	0.175	0.158
fears GA	0.147	0.230	0.056	0.055
self-esteem	0.164	0.226	0.079	0.091
no support	0.273	0.410	0.303	0.301
resemblance	0.162	0.235	0.021	0.042
minor, dispute	0.204	0.367	0.444	0.392
spousal pressure	0.136	0.171	0.393	0.348
impatient	0.044	0.134	0.219	0.341

Note. V=vignette; T=treatment option; B3B=perception of justification for cost of surgery in case of moderately compromised function

Table 5. ANOVA, LSQ-MEAN V*T*B3B

Vignette	B3B, Consult DDS		B3B, Second Opinion	
	Not Chosen	Chosen	Not Chosen	Chosen
developmental defect	0.250	0.383	0.104	0.090
traumatic defect	0.296	0.435	0.113	0.077
excellent esthetics	0.099	0.167	0.113	0.089
negative life	0.183	0.315	0.148	0.090
not listen	0.310	0.596	0.254	0.139
poor health	0.147	0.242	0.042	0.048
extrovert	0.129	0.246	0.086	0.048
self-image	0.182	0.361	0.070	0.066
introvert	0.126	0.358	0.077	0.067
intolerant	0.093	0.248	0.129	0.121
uncooperative	0.049	0.049	0.028	0.018
time/ cost	0.119	0.206	0.238	0.224
fears GA	0.301	0.576	0.056	0.036
self-esteem	0.150	0.329	0.064	0.037
no support	0.196	0.380	0.287	0.205
resemblance	0.127	0.301	0.077	0.048
minor, dispute	0.261	0.452	0.317	0.277
spousal pressure	0.314	0.537	0.293	0.134
impatient	0.175	0.250	0.022	0.012

Note. V=vignette; T=treatment option; B3B=perception of justification for cost of surgery in case of moderately compromised function.

Table 6. ANOVA, LSQ-MEAN V*T*B3B

Vignette	B3B, Consult Psychologist	
	Not Chosen	Chosen
developmental defect	0.056	0.030
traumatic defect	0.042	0.012
excellent esthetics	0.0	0.0
negative life	0.359	0.494
not listen	0.021	0.066
poor health	0.0	0.006
extrovert	0.029	0.006
self-image	0.042	0.042
introvert	0.084	0.061
intolerant	0.021	0.036
uncooperative	0.021	0.024
time/ cost	0.007	0.0
fears GA	0.035	0.036
self-esteem	0.264	0.268
no support	0.042	0.042
resemblance	0.0	0.006
minor, dispute	0.056	0.024
spousal pressure	0.064	0.091
impatient	0.007	0.006

Note. V=vignette; T=treatment option; B3B=perception of justification for cost of surgery in case of moderately compromised function

Table VII. Summary: Vignette (V) by Treatment Option (T) by Perception of Justification for Cost of Surgery in Case of Severely Compromised Esthetics (B3D)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	2250.66	423.18	2250.66	1.51	**1489.17**	1.0	280.0	**0.0***
B3D	4.19	423.18	4.19	1.51	2.77	1.0	280.0	0.09687
!V	Σ	0.76	1.82	0.11	**16.91**	13.7	4198.3	**0.487-6***
!B3D·V	Σ	0.76	0.07	0.11	0.69	13.7	4198.3	0.78266
!T	Σ	0.76	166.28	0.70	**237.02**	4.5	1430.7	**0.00007***
!B3D·T	Σ	0.76	0.72	0.70	1.03	4.5	1430.7	0.39522
!V·T	Σ	0.46	5.76	0.11	**54.81**	50.0	15242.4	**0.00023***
!B3D·V·T	Σ	0.46	0.11	0.11	1.09	50.0	15242.4	0.31211
c	*423.18	3462.99	1.51	0.11	**14.37**	280.0	32933.0	**0.00028***
V·c	*594.43	3462.99	0.11	0.11	1.02	5524.0	32933.0	0.12908
T·c	*1325.90	3462.99	0.70	0.11	**6.67**	1890.0	32933.0	**0.00062***
V·T·c	*3462.99	****	0.11	****	****	32933.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or *P < .001.

Table 8. ANOVA, LSQ-MEAN V*B3E

Vignette	B3E	
	Not Chosen	Chosen
developmental defect	0.254	0.293
traumatic defect	0.252	0.289
excellent esthetics	0.210	0.233
negative life	0.287	0.350
not listen	0.259	0.348
poor health	0.224	0.271
extrovert	0.244	0.323
self-image	0.266	0.323
introvert	0.270	0.348
intolerant	0.250	0.330
uncooperative	0.202	0.198
time/ cost	0.275	0.312
fears GA	0.254	0.359
self-esteem	0.300	0.373
no support	0.291	0.370
resemblance	0.248	0.331
minor, dispute	0.308	0.381
spousal pressure	0.287	0.339
impatient	0.222	0.286

Note. V=vignette; B3E=perception of justification for cost of surgery in case of moderately compromised esthetics

Table 9. ANOVA, LSQ-MEAN V*T*B3E

Vignette	B3E, Surgery		B3E, Camouflage	
	Not Chosen	Chosen	Not Chosen	Chosen
developmental defect	0.848	0.895	0.433	0.489
traumatic defect	0.778	0.866	0.415	0.515
excellent esthetics	0.273	0.336	0.812	0.843
negative life	0.494	0.619	0.466	0.500
not listen	0.309	0.564	0.526	0.586
poor health	0.069	0.158	0.760	0.647
extrovert	0.414	0.729	0.862	0.925
self-image	0.768	0.864	0.627	0.667
introvert	0.531	0.817	0.859	0.863
intolerant	0.356	0.573	0.517	0.626
uncooperative	0.023	0.031	0.080	0.038
time/ cost	0.333	0.458	0.667	0.710
fears GA	0.328	0.687	0.831	0.840
self-esteem	0.613	0.847	0.705	0.832
no support	0.316	0.583	0.565	0.682
resemblance	0.415	0.803	0.858	0.917
minor, dispute	0.312	0.545	0.534	0.591
spousal pressure	0.375	0.508	0.472	0.516
impatient	0.517	0.690	0.512	0.566

Note. V=vignette; T=treatment option; B3B=perception of justification for cost of surgery in case of moderately compromised function

Table 10. ANOVA, LSQ-MEAN V*T*B3E

Vignette	B3E, No Treatment		B3E, Delay Decision	
	Not Chosen	Chosen	Not Chosen	Chosen
developmental defect	0.067	0.098	0.208	0.038
traumatic defect	0.057	0.097	0.045	0.022
excellent esthetics	0.131	0.172	0.040	0.022
negative life	0.131	0.187	0.176	0.261
not listen	0.154	0.248	0.217	0.211
poor health	0.326	0.444	0.223	0.323
extrovert	0.172	0.248	0.034	0.023
self-image	0.130	0.205	0.023	0.038
introvert	0.136	0.221	0.051	0.031
intolerant	0.471	0.557	0.149	0.130
uncooperative	0.568	0.523	0.636	0.715
time/ cost	0.407	0.389	0.158	0.176
fears GA	0.141	0.260	0.073	0.031
self-esteem	0.168	0.237	0.075	0.099
no support	0.288	0.424	0.333	0.265
resemblance	0.193	0.212	0.034	0.030
minor, dispute	0.222	0.386	0.437	0.386
spousal pressure	0.125	0.195	0.392	0.336
impatient	0.058	0.140	0.250	0.333

Note. V=vignette; T=treatment option; B3B=perception of justification for cost of surgery in case of moderately compromised function

Table 11. ANOVA, LSQ-MEAN V•T•B3E

Vignette	B3E, Consult DDS		B3E, Second Opinion	
	Not Chosen	Chosen	Not Chosen	Chosen
developmental defect	0.270	0.391	0.096	0.098
traumatic defect	0.324	0.433	0.108	0.075
excellent esthetics	0.119	0.157	0.097	0.104
negative life	0.210	0.313	0.142	0.083
not listen	0.371	0.586	0.206	0.173
poor health	0.149	0.263	0.040	0.053
extrovert	0.132	0.271	0.069	0.060
self-image	0.220	0.356	0.056	0.083
introvert	0.169	0.359	0.062	0.084
intolerant	0.115	0.260	0.115	0.137
uncooperative	0.045	0.054	0.034	0.008
time/ cost	0.141	0.198	0.215	0.252
fears GA	0.328	0.611	0.045	0.046
self-esteem	0.179	0.336	0.064	0.031
no support	0.220	0.394	0.271	0.205
resemblance	0.159	0.303	0.074	0.045
minor, dispute	0.295	0.455	0.318	0.265
spousal pressure	0.358	0.539	0.222	0.187
impatient	0.192	0.248	0.017	0.016

Note. V=vignette; T=treatment option; B3B=perception of justification for cost of surgery in case of moderately compromised function

Table 12. ANOVA, LSQ-MEAN V•T•B3E

Vignette	B3E, Consult Psychologist	
	Not Chosen	Chosen
developmental defect	0.039	0.045
traumatic defect	0.034	0.015
excellent esthetics	0.0	0.0
negative life	0.392	0.485
not listen	0.029	0.068
poor health	0.0	0.008
extrovert	0.023	0.008
self-image	0.040	0.045
introvert	0.079	0.061
intolerant	0.029	0.031
uncooperative	0.028	0.015
time/ cost	0.006	0.0
fears GA	0.034	0.038
self-esteem	0.295	0.229
no support	0.045	0.038
resemblance	0.0	0.008
minor, dispute	0.040	0.038
spousal pressure	0.068	0.094
impatient	0.006	0.008

Note. V=vignette; T=treatment option; B3B=perception of justification for cost of surgery in case of moderately compromised function

Table 13. Summary: Vignette (V) by Treatment Option (T) by Perception of Justification for Cost of Surgery in Case of Mildly Compromised Esthetics (B3F)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	888.78	428.56	888.87	1.53	**580.74**	1.0	280.0	**0.0***
B3F	7.32	428.56	7.32	1.53	4.78	1.0	280.0	0.02956
!V	Σ	0.76	1.03	0.11	**9.57**	13.7	4192.9	**0.228E-5***
!B3F·V	Σ	0.76	0.18	0.11	1.67	13.7	4192.9	0.05578
T	Σ	0.75	61.52	0.70	**88.48**	4.5	1423.1	**0.303E-8***
!B3F·T	Σ	0.75	2.69	0.70	3.87	4.5	1423.1	0.00259
!V·T	Σ	0.45	1.98	0.11	**18.82**	50.0	15237.3	**0.00008***
!B3F·V·T	Σ	0.45	0.12	0.11	1.12	50.0	15237.3	0.26518
c	*428.56	3462.67	1.53	0.11	**14.56**	280.0	32933.0	**0.00028***
V·c	*592.97	3462.67	0.11	0.11	1.02	5524.0	32933.0	0.15507
T·c	*1314.18	3462.67	0.70	0.11	**6.[illegible]1**	1890.0	32933.0	**0.00058***
V·T·c	*3462.67	****	0.11	****	****	32933.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found *or* **P* < .001.

Table 14. Summary: Vignette (V) by Treatment Option (T) by Perception That Cost of Surgery is Unjustified (B3G)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	195.13	428.45	195.13	1.53	**127.52**	1.0	280.0	**0.455E-13***
B3G	0.34	428.45	0.34	1.53	0.22	1.0	280.0	0.63715
!V	Σ	0.76	0.39	0.11	**3.59**	13.7	4197.5	**0.00002***
!B3G·V	Σ	0.76	0.14	0.11	1.28	13.7	4197.5	0.21430
!T	Σ	0.76	13.89	0.70	**19.78**	4.5	1429.5	**0.194E-10***
!B3G·T	Σ	0.76	0.53	0.70	0.75	4.5	1429.5	0.57497
!V·T	Σ	0.46	0.68	0.11	**6.50**	50.0	15237.9	**0.00003***
!B3G·V·T	Σ	0.46	0.10	0.11	0.94	50.0	15237.9	0.59478
c	*428.45	3464.71	1.53	0.11	**14.54**	280.0	32933.0	**0.00028***
V·c	*593.28	3464.71	0.11	0.11	1.02	5524.0	32933.0	0.15581
T·c	*1327.03	3464.71	0.70	0.11	**6.67**	1890.0	32933.0	**0.00061***
V·T·c	*3464.71	****	0.11	****	****	32933.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found *or* **P* < .001.

APPENDIX XIV Hypothesis 5 ANOVA Summaries and LSQ-Means

Table 1. Summary: Vignette (V) by Treatment Option (T) by Willingness to Suspend Treatment for Anxious Surgical Patient (F3P)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	3201.67	429.38	3201.67	1.53	**2087.80**	1.0	280.0	**0.0***
F3P	12.24	429.38	12.24	1.53	7.98	1.0	280.0	0.00506
!V	Σ	0.76	2.92	0.11	**27.19**	13.7	4168.9	**0.906E-7***
!F3P·V	Σ	0.76	0.17	0.11	1.57	13.7	4168.9	0.08265
!T	Σ	0.75	231.48	0.71	**327.60**	4.5	1396.8	**0.0***
!F3P·T	Σ	0.75	0.74	0.71	1.05	4.5	1396.8	0.38416
!V·T	Σ	0.46	7.93	0.11	75.27	50.1	15123.4	**0.00030***
!F3P·V·T	Σ	0.46	0.10	0.11	0.99	50.1	15123.4	0.49745
c	*429.38	3435.58	1.53	0.11	**14.55**	280.0	32602.0	**0.00026***
V·c	*585.90	3435.58	0.11	0.11	1.02	5463.0	32602.0	0.19563
T·c	*1310.72	3435.58	0.71	0.11	**6.71**	1855.0	32602.0	**0.00058***
V·T·c	*3435.58	****	0.11	****	****	32602.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or *P < .001.

Table 2. Summary: Vignette (V) by Treatment Option (T) by Willingness to Refer Anxious Surgical Patient to Psychologist Prior to Decision Not to Proceed With Surgery (F3G)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	3178.79	416.47	3178.79	1.49	**2137.17**	1.0	280.0	**0.0***
F3G	22.63	416.47	22.63	1.49	**15.22**	1.0	280.0	**0.00012***
!V	Σ	0.76	2.82	0.11	**26.31**	13.7	4162.8	**0.709E-7***
!F3G·V	Σ	0.76	0.16	0.11	1.53	13.7	4162.8	0.09219
!T	Σ	0.75	219.68	0.71	**310.92**	4.5	1398.5	**0.0***
!F3G·T	Σ	0.75	0.77	0.71	1.10	4.5	1398.5	0.35961
!V·T	Σ	0.46	7.93	0.11	**75.43**	50.2	15157.8	**0.00030***
!F3G·V·T	Σ	0.46	0.19	0.11	1.77	50.2	15157.8	**0.00076***
c	*416.47	3426.73	1.49	0.11	**14.15**	280.0	32602.0	**0.00028***
V·c	*586.04	3426.73	0.11	0.11	1.02	5463.0	32602.0	0.16022
T·c	*1310.67	3426.73	0.71	0.11	**6.72**	1855.0	32602.0	**0.00058***
V·T·c	*3426.73	****	0.11	****	****	32602.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or *P < .001.

Table 3. ANOVA, LSQ-MEAN V*T*F3G

Vignette	F3G, Surgery		F3G, Camouflage	
	Not Chosen	Chosen	Not Chosen	Chosen
developmental defect	0.881	0.866	0.440	0.482
traumatic defect	0.813	0.830	0.451	0.473
excellent esthetics	0.287	0.306	0.795	0.874
negative life	0.549	0.559	0.477	0.468
not listen	0.425	0.402	0.575	0.500
poor health	0.113	0.090	0.716	0.685
extrovert	0.578	0.505	0.875	0.901
self-image	0.803	0.830	0.642	0.643
introvert	0.648	0.661	0.829	0.902
intolerant	0.416	0.500	0.537	0.598
uncooperative	0.031	0.018	0.057	0.054
time/ cost	0.373	0.411	*0.622	*0.777
fears GA	0.482	0.473	0.803	0.875
self-esteem	0.702	0.736	0.785	0.700
no support	0.412	0.455	0.588	0.652
resemblance	0.585	0.580	0.865	0.902
minor, dispute	0.399	0.429	0.560	0.536
spousal pressure	0.458	0.393	0.484	0.500
impatient	0.581	0.600	*0.482	*0.609

Note. Multiple comparisons: $\alpha = 0.05$; required difference = 0.11; *SE* = 0.04; *df* = 17618; Scheffé = 2.80; * observed difference exceeded required difference. V=vignette, T=treatment option, F3G=willingness to refer anxious surgical patient to psychologist prior to decision not to proceed with surgery.

Table 4. ANOVA, LSQ-MEAN V*T*F3G

Vignette	F3G, No Treatment		F3G, Delay Decision	
	Not Chosen	Chosen	Not Chosen	Chosen
developmental defect	0.062	0.116	0.036	0.027
traumatic defect	0.057	0.107	0.031	0.045
excellent esthetics	0.123	0.207	0.041	0.018
negative life	0.138	0.171	0.195	0.252
not listen	0.176	0.214	0.161	0.312
poor health	0.345	0.432	0.232	0.324
extrovert	0.182	0.234	0.026	0.036
self-image	0.150	0.170	0.016	0.045
introvert	0.150	0.205	0.047	0.045
intolerant	0.479	0.571	0.137	0.161
uncooperative	0.492	0.640	0.648	0.712
time/ cost	0.368	0.464	0.140	0.232
fears GA	0.181	0.214	0.052	0.062
self-esteem	0.178	0.218	0.058	0.136
no support	0.330	0.375	0.263	0.384
resemblance	0.192	0.205	0.036	0.027
minor, dispute	0.275	0.312	0.363	0.509
spousal pressure	0.126	0.214	0.337	0.429
impatient	0.079	0.109	0.267	0.336

Note. V=vignette; T=treatment option; F3G=willingness to refer anxious surgical patient to psychologist prior to decision not to proceed with surgery

Table 5. ANOVA, LSQ-MEAN V*T*F3G

Vignette	F3G, Consult DDS		F3G, Second Opinion	
	Not Chosen	Chosen	Not Chosen	Chosen
developmental defect	0.301	0.375	0.083	0.125
traumatic defect	0.347	0.420	0.067	0.143
excellent esthetics	0.123	0.171	0.072	0.153
negative life	0.236	0.315	0.097	0.155
not listen	0.415	0.571	0.150	0.250
poor health	0.160	0.243	0.041	0.054
extrovert	0.167	0.243	0.052	0.090
self-image	0.249	0.339	0.031	0.134
introvert	0.228	0.304	0.052	0.107
intolerant	0.158	0.214	0.095	0.179
uncooperative	0.036	0.063	0.010	0.045
time/ cost	0.130	0.232	0.197	0.304
fears GA	0.420	0.518	0.041	0.054
self-esteem	0.236	0.273	0.047	0.055
no support	0.289	0.312	0.216	0.277
resemblance	0.212	0.241	0.057	0.071
minor, dispute	0.332	0.437	0.264	0.348
spousal pressure	0.411	0.482	0.179	0.250
impatient	0.209	0.218	0.016	0.018

Note. V=vignette; T=treatment option; F3G=willingness to refer anxious surgical patient to psychologist prior to decision not to proceed with surgery

Table 6. ANOVA, LSQ-MEAN V*T*F3G

Vignette	F3G, Consult Psychologist	
	Not Chosen	Chosen
developmental defect	0.026	0.071
traumatic defect	0.010	0.054
excellent esthetics	0.0	0.0
***negative life**	**0.318**	**0.649**
not listen	0.031	0.071
poor health	0.0	0.009
extrovert	0.0	0.045
self-image	0.021	0.080
introvert	0.041	0.134
intolerant	0.005	0.071
uncooperative	0.010	0.045
time/ cost	0.0	0.009
fears GA	0.005	0.089
***self-esteem**	**0.188**	**0.400**
no support	0.005	0.107
resemblance	0.0	0.009
minor, dispute	0.016	0.080
***spousal pressure**	**0.026**	**0.170**
impatient	0.0	0.018

Note. Multiple comparisons: $\alpha = 0.05$; required difference = 0.14; *SE* = 0.04; *df* $\geq$ 17618; Scheffé = 3.75; * observed difference exceeded required difference.

APPENDIX XV Hypothesis 6 ANOVA Summaries

Table 1. Summary: Vignette (V) by Treatment Option (T) by Self-Assessment of Respondents' Facial Esthetics (A1)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	2930.49	420.86	2930.49	1.53	**1914.87**	1.0	275.0	**0.0***
A1	5.21	420.86	2.60	1.53	1.70	2.0	275.0	0.18435
!V	Σ	0.76	2.61	0.11	**24.61**	13.7	4138.8	**0.263E-6***
!A1·V	Σ	0.76	0.10	0.11	0.95	27.5	4138.8	0.54323
!T	Σ	0.76	227.39	0.69	**327.96**	4.5	1406.0	**0.0***
!A1·T	Σ	0.76	1.67	0.69	2.40	9.1	1406.0	0.01035
!V·T	Σ	0.46	7.16	0.10	**68.24**	49.8	14889.2	**0.00026***
!A1·V·T	Σ	0.46	0.13	0.10	1.22	99.5	14889.2	0.06428
c	*420.86	3390.55	1.53	0.10	**14.59**	275.0	32321.0	**0.00028***
V·c	*575.81	3390.55	0.11	0.10	1.01	5422.0	32321.0	0.27503
T·c	*1289.60	3390.55	0.69	0.10	**6.61**	1860.0	32321.0	**0.00058***
V·T·c	*3390.55	****	0.10	****	****	32321.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or **P* < .001.

Table 2. Summary: Vignette (V) by Treatment Option (T) by Objective Assessment of Respondents' Facial Structure by a Colleague (A2)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	1964.99	413.85	1964.99	1.49	**1215.22**	1.0	277.0	**0.0***
A2	13.02	413.85	4.34	1.49	2.91	3.0	277.0	0.03514
!V	Σ	0.76	1.59	0.11	**14.81**	13.6	4135.9	**0.100E-5***
!A2·V	Σ	0.76	0.10	0.11	0.89	40.8	4135.9	0.67138
!T	Σ	0.76	153.11	0.70	**220.30**	4.5	1423.9	**0.00007***
!A2·T	Σ	0.76	1.19	0.70	1.71	13.6	1423.9	0.04963
!V·T	Σ	0.46	4.77	0.10	**45.60**	49.8	15045.7	**0.00019***
!A2·V·T	Σ	0.46	0.12	0.10	1.18	149.4	15045.7	0.07145
c	*413.85	3412.30	1.49	0.10	**14.29**	277.0	32632.0	**0.00028***
V·c	*587.01	3412.30	0.11	0.10	1.03	5475.0	32632.0	0.11146
T·c	*1305.92	3412.30	0.70	0.10	**6.65**	1879.0	32632.0	**0.00058***
V·T·c	*3412.30	****	0.10	****	****	32632.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or **P* < .001.

Table 3. Summary: Vignette (V) by Treatment Option (T) by Objective Assessment of Surgical Option for Respondents' Treatment Needs (A3A)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	1678.87	417.52	1678.87	1.49	**1129.92**	1.0	281.0	**0.0***
A3A	10.48	417.52	10.48	1.49	7.06	1.0	281.0	0.00835
!V	Σ	0.76	1.52	0.11	**14.20**	13.7	4206.8	**0.891E-6***
!A3A·V	Σ	0.76	0.09	0.11	0.84	13.7	4206.8	0.62605
!T	Σ	0.75	127.55	0.70	**182.65**	4.5	1436.0	**0.00004***
!A3A·T	Σ	0.75	1.61	0.70	2.30	4.5	1436.0	0.04872
!V·T	Σ	0.46	3.88	0.11	**36.95**	50.1	15328.5	**0.00015***
!A3A·V·T	Σ	0.46	0.11	0.11	1.09	50.1	15328.5	0.30486
c	*417.52	3474.19	1.49	0.11	**14.14**	281.0	33064.0	**0.00028***
V·c	*594.16	3474.19	0.11	0.11	1.02	5547.0	33064.0	0.17268
T·c	*1328.95	3474.19	0.70	0.11	**6.65**	1903.0	33064.0	**0.00062***
V·T·c	*3474.19	****	0.11	****	****	33064.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or **P* < .001.

Table 4. Summary: Vignette (V) by Treatment Option (T) by Objective Assessment of Camouflage Option for Respondents' Treatment Needs (A3B)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	738.49	425.23	738.49	1.51	**488.01**	1.0	281.0	**0.0***
A3B	1.16	425.23	1.16	1.51	0.77	1.0	281.0	0.38182
!V	Σ	0.76	0.96	0.11	**8.93**	13.7	4207.7	**0.238E-5***
!A3B·V	Σ	0.76	0.11	0.11	1.05	13.7	4207.7	0.39845
!T	Σ	0.75	53.52	0.70	**76.18**	4.5	1433.6	**0.257E-8***
!A3B·T	Σ	0.75	0.25	0.70	0.36	4.5	1433.6	0.86029
!V·T	Σ	0.46	1.85	0.11	**17.59**	50.1	15327.2	**0.00005***
!A3B·V·T	Σ	0.46	0.12	0.11	1.18	50.1	15327.2	0.18315
c	*425.23	3473.23	1.51	0.11	**14.41**	281.0	33064.0	**0.00028***
V·c	*593.72	3473.23	0.11	0.11	1.02	5547.0	33064.0	0.17852
T·c	*1336.99	3473.23	0.70	0.11	**6.69**	1903.0	33064.0	**0.00061***
V·T·c	*3473.23	****	0.11	****	****	33064.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or **P* < .001.

Table 5. Summary: Vignette (V) by Treatment Option (T) by Objective Assessment of Conventional Orthodontic Option for Respondents' Treatment Needs (A3C)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	2856.51	426.21	2856.51	1.52	**1883.28**	1.0	281.0	**0.0***
A3C	0.16	426.21	0.16	1.52	0.11	1.0	281.0	0.74199
!V	Σ	0.76	2.44	0.11	**22.76**	13.7	4208.3	**0.421E-6***
!A3C·V	Σ	0.76	0.09	0.11	0.80	13.7	4208.3	0.67217
!T	Σ	0.76	209.13	0.70	**298.92**	4.5	1437.1	**0.00007***
!A3C·T	Σ	0.76	1.24	0.70	1.77	4.5	1437.1	0.12322
!V·T	Σ	0.46	7.20	0.11	**68.47**	50.0	15317.5	**0.00026***
!A3C·V·T	Σ	0.46	0.09	0.11	0.90	50.0	15317.5	0.67286
c	*426.21	3476.39	1.52	0.11	**14.43**	281.0	33064.0	**0.00028***
V·c	*594.30	3476.39	0.11	0.11	1.02	5547.0	33064.0	0.17781
T·c	*1331.35	3476.39	0.70	0.11	**6.65**	1903.0	33064.0	**0.00061***
V·T·c	*3476.39	****	0.11	****	****	33064.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or **P* < .001.

Table 6. Summary: Vignette (V) by Treatment Option (T) by Objective Assessment of Minor Orthodontic Interceptive Option for Respondents' Treatment Needs (A3D)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	1071.71	424.31	1071.71	1.51	**709.74**	1.0	281.0	**0.0***
A3D	2.29	424.31	2.29	1.51	1.52	1.0	281.0	0.21890
!V	Σ	0.76	0.83	0.11	**7.76**	13.7	4214.5	**0.285E-5***
!A3D·V	Σ	0.76	0.07	0.11	0.62	13.7	4214.5	0.85088
!T	Σ	0.75	87.52	0.70	**125.04**	4.5	1429.8	**0.00004***
!A3D·T	Σ	0.75	1.09	0.70	1.56	4.5	1429.8	0.17558
!V·T	Σ	0.46	2.82	0.11	**26.83**	50.0	15312.7	**0.00012***
!A3D·V·T	Σ	0.46	0.09	0.11	0.89	50.0	15312.7	0.68372
c	*424.31	3476.45	1.51	0.11	**14.36**	281.0	33064.0	**0.00028***
V·c	*594.54	3476.45	0.11	0.11	1.02	5547.0	33064.0	0.17287
T·c	*1331.91	3476.45	0.70	0.11	**6.66**	1903.0	33064.0	**0.00061***
V·T·c	*3476.45	****	0.11	****	****	33064.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or **P* < .001.

Table 7. Summary: Vignette (V) by Treatment Option (T) by Objective Assessment of No Treatment Option for Respondents' Treatment Needs (A3E)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	3306.89	420.50	3306.89	1.50	**2209.82**	1.0	281.0	**0.0***
A3E	5.15	420.50	5.15	1.50	3.44	1.0	281.0	0.06452
!V	Σ	0.76	2.90	0.11	**27.03**	13.7	4207.9	**0.204E-6***
!A3E·V	Σ	0.76	0.09	0.11	0.81	13.7	4207.9	0.66006
!T	Σ	0.75	249.59	0.70	**355.73**	4.5	1436.2	**0.0***
!A3E·T	Σ	0.75	0.57	0.70	0.82	4.5	1436.2	0.52753
!V·T	Σ	0.46	8.22	0.11	**78.18**	50.0	15309.4	**0.00034***
!A3E·V·T	Σ	0.46	0.11	0.11	1.01	50.0	15309.4	0.44724
c	*420.50	3475.09	1.50	0.11	**14.24**	281.0	33064.0	**0.00028***
V·c	*594.15	3475.09	0.11	0.11	1.02	5547.0	33064.0	0.17614
T·c	*1335.18	3475.09	0.70	0.11	**6.68**	1903.0	33064.0	**0.00061***
V·T·c	*3475.09	****	0.11	****	****	33064.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or *$P < .001$.

APPENDIX XVI Hypothesis 30 ANOVA Summary

Table I. Summary: Vignette (V) by Treatment Option (T) by Quality of Oral Surgeon's Discussion of Surgical Risks with Patient (G9)

Model Part	*SSH*	*SSE*	*MSH*	*MSE*	*F*-Ratio	*DFH*	*DFE*	*P*
GM	2236.46	480.41	2236.46	1.75	**1275.56**	1.0	274.0	**0.0***
G9	0.36	480.41	0.36	1.75	0.21	1.0	274.0	0.64935
!V	Σ	0.75	4.85	0.16	**30.62**	12.8	3764.9	**0.124E-11***
!G9·V	Σ	0.75	0.15	0.16	0.95	12.8	3764.9	0.50150
!T	Σ	0.93	125.63	0.78	**160.98**	1.9	572.9	**0.321E-7***
!G9·T	Σ	0.93	1.40	0.78	1.80	1.9	572.9	0.16909
!V·T	Σ	0.69	8.86	0.12	**73.74**	23.5	6858.8	**0.00015***
!G9·V·T	Σ	0.69	0.17	0.12	1.42	23.5	6858.8	0.08457
c	*480.41	1194.90	1.75	0.12	**14.59**	274.0	9944.0	**0.00023***
V·c	*792.60	1194.90	0.16	0.12	**1.32**	5005.0	9944.0	**0.00002***
T·c	*479.20	1194.90	0.78	0.12	**6.49**	614.0	9944.0	**0.00016***
V·T·c	*1194.90	****	0.12	****	****	9944.0	****	****

Note. · = interaction; * = use of residual where appropriate error term could not be found or **P* < .001.

APPENDIX XVII Respondent Comment Summary

Part 1. Comments Pertinent to Major Hypotheses

Vignette	Patient Decides (*n*)	Favour Surgery (*n*)	Favour Camouflage (*n*)
D1	30	1	3
D2	30	1	1
D3	9	5	2
D4	12	0	4
D5	18	1	1
D6	11	1	0
D7	6	0	7
D8	10	2	4
D9	13	1	0
D10	17	1	1
D11	18	2	2
D12	13	2	3
D13	3	0	0
D14	15	2	1
D15	14	2	8
D16	13	3	0
D17	6	0	0
E1	14	0	4
E2	11	0	4
E3	6	1	3
E4	8	0	2
F3	9	0	0
G4	7	0	2

Note. *N* = 304 to 334

Part 2. Uncategorized Comments.

Questionnaire.
'I found the questions too hypothetical'

'Please put these questions into 1 page that takes 3 minutes to fill out'

A5. How would YOU want your borderline case treated?

'I would risk surgery for myself but not for my child'

B2. Cost of surgery as burden to health care system.

'low in comparison to cost of other types of surgery covered'

'there can't be that many people having orthognathic surgery compared to other surgery'

B3. How you feel regarding the cost of surgery.

*'the cost to whom?'

'mild to whom?'

B4. Percentage surgery covered by health care.

'genioplasty alone not covered; with jaw surgery covered 95%'

'<50% if done by plastic surgeon; 50% if performed by maxillofacial surgeon'

'50% if done by oral surgeon, 100% if done by plastic surgeon'

B5. Surgical components funded by health care.

'rhinoplasties?'

B6. Importance of surgeons' fees to choice of surgeon.

'in hardship cases only...some surgeons don't extra bill'

'if patient can't pay I send him to a plastic surgeon'

C1. Skeletal age limit to growth modification.

'I use growth curves, wrist plates, ideally both'

'for Class II, male age 15, female age 14; for Class III, male age 20, female age 18'

C10. Growth modification can be achieved after age 18.

'for minor changes'

'if severe Class III or open bite... no growth modification, surgery is necessary in late teens'

'orthopedic changes not necessarily the same as growth modification, eg. RPE'

C20. Surgery is an option before age 8.

'consider post-surgical growth disruption'

'depends on how badly psychological development is being hampered'

C30. Latest feasible surgery.

*'no limit given good medical health'

'no limit given no perio problems'

'if the patient lived for 50 years with his problem surely he can live with it for the rest of his life'

'I treat every patient as I would my child. An adult patient is given all options'

'provided the patient can enjoy the treatment results for a minimum of 10 years, older patient if severe problem'

Vignettes.

*'I simply provide information and allow them to make an informed decision'

D1. Developmental defect.

'Depends on patient perception of esthetic problem'

D3. TMJ dysfunction.

*'1) splint 2) reevaluate'

'I believe stress is a big etiologic factor and not malocclusion'

'I do not agree the skeletal discrepancy or malocclusion contribute to TMJ dysfunction'

D4. Excellent existing facial esthetics.

'cosmetic dentistry'

'I am not sure how excellent facial esthetics can co-exist with skeletal discrepancy'

D5. Negative life events.

*'warn patient that facial change won't change negative life events'

'stall patient until they're stable and able to make a wise choice'

D6. Doesn't listen seriously to discussion of surgical risks.

'schedule another consultation with another adult close to the patient'

D7. Poor general health.

*'refer for medical exam to determine advisability of proceeding with treatment'

D8. TMJ dysfunction with existing excellent facial esthetics, option e.

'radiology, rheumatology, internist'

'oral surgeon, radiologist'

'physiotherapy'

'reconstructive prosthodontics'

'osteopath'

'stress management'

D9. Extrovert.

'I doubt this patient would seek orthodontic treatment'

'Extroverted/positive people are more likely to accept my recommendation'

D10. One inconsistent facial feature.

'surgery if the mandible is prominent; camouflage if the maxilla is prominent'

D11. Introvert.

'How does an orthodontist diagnose intro/extroversion?'

D12. Intolerant of discomfort/inconvenience.

'What is this patient's orthodontic problem?'

'This will usually be a difficult to impossible patient'

D13. Uncooperative.

*'shape up or ship out'

*'oral hygiene must be monitored by family dentist and periodontist'

*'reeducate, give them one more chance, reevaluate'

'delay extractions, irreversible treatment'

'reassess in 3-4months or postpone indefinitely until patient keen'

D14. Concern about treatment time/cost.

*'surgical orthodontics generally shorter in treatment time'

'traitment de compromis (correction partielle)'

'convince the patient of what is best for them'

'advise patient that I am a health specialist, not a used car salesman'

'in my opinion mdst borderline cases are treated conventionally'

D15. Fears general anaesthetic.

'refer for consult with anaesthetist'

'review GA with oral surgeon and patient, and if the patient is still unhappy, ortho only'

D16. Low self-esteem.

'the patient must understand that his self-esteem won't improve with ortho'

D17. Indecisive patient wants orthodontist to help make the decision.

*'P or Q?'

'the patient must be the one to select the treatment plan'

E1. 'Support' system nonsupportive of treatment.

'at a second consult include family members who need to hear consult.

'patient is capable of making their own choice'

'delay until the family is in agreement on which procedure to do'

'I would lean toward a non-surgical approach'

'find out what means more to the patient, opinion of family or self'

'refer family to psychologist'

'if patient is internally motivated, the family need a psychologist'

E2. Family resemblance.

'Does patient wish a change?'

'are the sibs attractive?'

'discuss with family'

E3. Minor wants surgery, parents disagree.

*'delay treatment until patient is at age of majority'

'final decision is the parents'

'see psychologist if they can't resolve dispute'

'no treatment if patient is unhappy with parental decision'

'this hardly ever happens'

E4. Patient apprehensive of surgery, spouse favours surgery.

'have a new consult with spouse present'

F1. Predict immediate post-surgical response for vigilant coper.

'I don't see how you can tell from the scenario you have put here'

*'clearly depends on post-surgical morbidity'

'risks overstated and patient relieved'

'immediate post-surgical is never positive due to nature of surgery'

F3. Anxious patient wants to abort surgery.

'consult with patients who have undergone similar surgeries'

'send patient back to oral surgeon to address fears'

'do whatever you can, it happens'

'finish with overjet, open bite, etc, but get good buccal interdigitation'

'he is terribly normal'

G1. Availability of oral surgeons.

'There are not enough'

G4. Patient is anxious to start surgery despite delay.

'refer to another surgeon'

'start now, book surgical consult ASAP, review risks of surgery'

'I can see no reason for rushing this treatment plan.